West Valley Demonstration Project

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Revision Number 8

Revision Date 06/16/2003

Engineering Release 4307

HLW: YES ___ **NO** ___ **N/A** X

DESIGN CRITERIA

REMOTE HANDLED WASTE FACILITY DESIGN CRITERIA

Signature and Date on File in Records & Configuration/Document Control

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WVNSCO RECORD OF REVISION

Rev. No.	Description of Changes	Revision On Page(s)	Dated
0	Original Issue	All	03/26/99
1	Per ECN #12115	2-6, 8, 13-17, 19, 20, 23, 26, 30-32, 34 36-39, 41-44, 46, 47	06/29/99
2	Per ECN#12475A Incorporated information from Attachments 1 and 2 of WVNS-FRD-004 as Attachment A - Table I	1,2,4	05/22/00
	The daily throughput (i.e., production) rate for the RHWF is base on two shifts per day, five (not seven) days per week. (Sect. 3.8)	2	
	Clarified that the Waste Acceptance Criteria (WAC) for Class B and C LLW is to be based on the WAC's for NTS and/or Hanford DOE. The WAC for Class A LLW is to be based on the WAC for Envirocare. (4.1.2A)	5	
	Listed the systems that comprise the security alarm and monitoring systems (4.1.4A)	7	
	Specified that rest room facilities shall be handicapped accessible. (4.1.5K)	8	
	Clarified that the additional HVAC exhaust capacity is to be reserved for excess infiltration of air. (5.0)	15	
	Allow the use of piping code ANSI B 31.9 in addition to ANSI B 31.3 (5.4; 5.4.1B) (10.1)	19, 50	
	Specified that all natural gas piping and natural gas heaters shall be located outside of the RHWF. (5.4.1K)	20	
	Excluded service factor when sizing motors. (5.5.4C)	22	

WVNSCO RECORD OF REVISION CONTINUATION FORM

Rev. No.	Description of Changes	Revision On Page(s)	Dated
2 (Cont.)	Clarified that UPS power is to be provided to allow monitoring and prevent shutdown of the HVAC system. (5.5.6A)	23	
	Deleted requirements for a centralized control station, allowing the use of local controls and/or alarms as appropriate. (5.6.1D.1, 5.6.2)	24	
	Clarified that provisions for installing the existing Integrated Waste Tracking System does not include connection to Other RHWF control systems.	25	
	Added a requirement that alarms shall be fail-safe with contacts opening to alarm so that broken wires will be indicated. (5.6.2)	25	
	Noted that the Work Cell bridge crane shall have the capability to lift loads weighing up to 30 tons by using the 20 ton hoist and 10 ton telescoping tube independently. Clarified movement of trolley. (5.7.1).	26	
	Added a requirement that a system for supporting temporary shielding shall be incorporated into the facility design. (6.3.1E)	31	
	Clarified requirement to allocate space for the erection of containment tents at the entrance to single air locks. (6.4.1C)	33	
	Specified that natural gas piping shall not be routed near air supply intakes. (6.4.2B)	34	
	Added a description of the in-cell prefilters (6.4.2 C1)	34	
	The design margin for the HVAC Exhaust System was increased from 15% to 33% to accommodate excess infiltration of air. (5.0 & 6.4.3 D1)	15, 37	
	Updated the list of service utilities from the existing plant as follows: (7.3)	48	

WVNSCO RECORD OF REVISION CONTINUATION FORM

Rev. No.	Description of Changes	Revision On Page(s)	Dated
2 (Cont.)	- Utility air and breathing air are to be provided by compressors inside of the RHWF - Cooling water is not required, as HVAC systems are air-cooled. - Added demineralized water, fire water & instrument air. - Added maximum available capacity for all utilities.		
	Other editorial changes were made that do not affect the technical base line.	1, 2, 5, 6, 7, 9, 13, 14, 15, 16, 17, 18, 19, 20, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 38, 39, 44, 47, 48, 51, 54 & 55	
	Added Table I as Attachment "A"	56	
3	B-25 loaded weight reduced from 12,140 lbs. to 11,000 lbs.	5	04/30/01
	Added radiographic ultrasonic as an option for inspection of piping.	19	
	Clarified isolation requirements (double blocks and bleeds) for piping tie-in with other facilities.	19	
	Revised grounding system resistance to ground from 5 ohms to 10 ohms or less.	24	
	Cell crane lift ratings revised; the main hook (cable hoist) will be rated for 30 tons, from previous rating of 20 tons.	26	
	The telescopic tube rating revised from 10 tons to 3 tons.	26	
	Deleted the requirement for the Work Cell bridge to have the capability to lift up to 30 tons load using 20 ton hoist and 10 ton telescoping tube.	26	

WVNSCO RECORD OF REVISION CONTINUATION FORM

Rev. No.	Description of Changes	Revision On Page(s)	Dated
3(Cont.)	Revised rating for the hoist from 20 tons to 30 tons.	26	
	Added radio controlled feature to Receiving Area Crane to act as a backup for the Work Cell Crane.	26, 27	
	Changed “powered roller conveyers (PRCs)” to “powered roller systems (PRSs).”	28	
	Reclassified RHWF HVAC System as Safety Class C from Safety Class B.	29	
	Revised document number RC-ALARA-06 from RC-ADM-11	29	
	Added statement that PAO testing during operation will not be required.	34	
	Clarified HVAC system redundant equipment should allow for “reducing the need for make-up air.”	36	
	Add WVNS-FHA-014 reference document number	39	
	Increased standby Electrical Maximum available capacity from 85 KVA to 200 KVA.	48	
	Fire alarm at main gatehouse	48	
	Other editorial changes were made that do not affect the technical base line.	3, 27, 47 , 56	
	Update current SOP 300-07. SOP 09-02 is canceled	43	
4	Per ECN 13128		06/12/01
	§5.4.2 - Deleted parenthetical reference to NYCRR 383-7.4(f)&(g) as this code only pertains to land disposal facilities.	20	
	§5.8.5 - Corrected citations for Safety Standards by inserting “ANSI” before standard number and deleting publication dates.	28	
	§6.5.2 - Deleted reference to 40 CFR 173. 40 CFR 173 deals with pesticide releases and has no bearing on RHWF gaseous releases.	44	

WVNSCO RECORD OF REVISION CONTINUATION FORM

Rev. No.	Description of Changes	Revision On Page(s)	Dated
4 (Cont.)	§10.1, Commercial Codes and Standards: Reidentified ASME B31-9 as ANSI B31.9, Building Service Piping Added references to: ANSI Z223.1 (Referenced in §5.0.A.5) ANSI/ANS-8.7-1975, R87 (Referenced in §6.4.4) NEC (Referenced in §5.5) NEC 760 (Referenced in §6.4.5.D.3) NEMA ICS (Referenced in §5.5.5.A) NEMA 1B-1 (Referenced in §5.5.6.B) NEMA RI-2 (Referenced in §5.5.6.B) NEMA ST 20 (Referenced in §5.5.3) NEMA MG-1 (Referenced in §5.5.4) NFPA 24 (Referenced in §5.0.F.4) NFPA 72 (Referenced in §6.4.5.D) NFPA 90A (Enveloped under NFPA) NFPA 90B (Enveloped under NFPA) NFPA 780 (Referenced in §5.5.8) NFPA 801 (Referenced in §6.4.5) UBC-1991 (Referenced in §5.1.1) Revised list to be in alphabetical order.	49-50	
	§10.2, U. S. Department of Energy Documents: Deleted references to the following DOE Documents because they do not contain or establish design requirements: DOE O 430.1, Life Cycle Asset Management DOE P 450.1, Environmental, Safety, and Health Policy for the DOE Complex DOE P 450.2A, Identification, Implementation, and Compliance with Environmental, Safety, and Health Requirements DOE O 451.1A, National Environmental Policy Act Compliance Program DOE Order 5400.1, General Environmental Protection Program DOE Order 5400.5, Radiation Protection of the Public and the Environment DOE Order 5633.3B, Control and Accountability of Nuclear Materials	51-52	

WVNSCO RECORD OF REVISION CONTINUATION FORM

Rev. No.	Description of Changes	Revision On Page(s)	Dated
4 (Cont.)	Replaced DOE Order 5820.2A with DOE O 435.1, Radioactive Waste Management (O 435.1 referenced in §6.1) Added: DOE/EH-0173T (Referenced in §6.5.2) DOE Order 5480.1, Chapter XI (Referenced in §6.4.8.B) Updated revisions of: DOE O 414.1A, Quality Assurance and DOE O 440.1A, Worker Protection Revised remaining listings to be in alphabetical order and made editorial corrections to citations.		
	§10.3, State Documents: Replaced references to specific parts of 6 NYCRR with a general reference to 6 NYCRR, Official Compilation of Codes and Regulations of the State of New York	52	
	§10.4, Federal Regulations: Added reference to 10 CFR 830.120 (the QA Rule) (Referenced in § 8.0) Deleted department references from CFR citations.	53	
|	§10.7, WVNSCO Design Guides Renumbered to be Section 10.6 Relocated: WVDP-112 to §10.7 from §11.0 (Referenced in §7.2.1.B) SOP 300-07 to §10.7 from §11.0 (Referenced in §6.5.1) Deleted reference to SOP 09-02 (SOP canceled) Added: QM 3 (Referenced in §6.2) WVDP-111 (Referenced in §8.0) WVNS-FHA-014 (Referenced in §6.4.5) Editorial corrections to citations for EMP-300 and EMP-301 Revised to be in alphabetical order.	54-55	
	§10.6 & §11.0: Relocated all of old §10.6 (Applicable Congressional Acts) to §11.0 (References) as they are not applicable codes and standards and do not identify specific design requirements. Relocated U.S. District Court citation (No. 86-1052-C) from §10.2 to §11.0 as it does not establish design requirements.	54-55	

WVNSCO RECORD OF REVISION CONTINUATION FORM

Rev. No.	Description of Changes	Revision On Page(s)	Dated
5	Per ECN #13201		11/06/01
	Changed signature responsibilities.	Cover sheet	
	Corrected typographical error	iii	
	Corrected P&ID definition in acronym list	xiii	
	Added WVNS to acronym list	xiv	
	§2.0 - Deleted reference to Remote-Handled Waste System.	1	
	§2.0 - Reworded sentence to emphasize that final characterization is outside the RHWF.	1	
	Changed “should,” “will” and “must” to “shall” in various paragraphs.	1, 2, 3, 26	
	§3.5 - Deleted reference to void filling.	2	
	§3.7 - Section rewritten to add details for the CCTV system.	2	
	§3.8 - Last sentence reworded for clarity.	2	
	§3.10 - Deleted reference to DOE 5480.2AII3e.	2	
	§3.11 - Added new section for waste characterization.	3	
	§3.11.1 - Added new section for weight measuring system.	3	
	§3.12 - Renumbered old §3.11 to be 3.12 and renumbered remaining sections under 3.0.	3	
	§3.14 - Reworded for clarity.	3	
	§3.15 - Added paragraph to discuss MSM penetration sleeves and embedment plates.	4	
	§4.0 - Rewritten for clarity.	4	
	§4.1.1 - Reworded for clarity.	4	
	§4.1.1C - Added the words “during processing.”	4	

WVNSCO RECORD OF REVISION CONTINUATION FORM

Rev. No.	Description of Changes	Revision On Page(s)	Dated
5 (Cont.)	§4.1.1E - Delete the words “and limited decontamination”	4	
	§4.1.1I - Added the words “to allow hands-on maintenance of equipment”	4	
	§4.1.1J - Deleted reference to method of disposition.	5	
	§4.1.2 - Reword for clarity.	5	
	§4.1.2C - Deleted “930 lb maximum.”	5	
	§4.1.3 - Added the words “by WVNS”	6	
	§4.1.4A - Deleted first sentence.	7	
	§4.1.5K - Deleted “an adjacent, attached.”	8	
	§4.1.7I - Reworded for clarity.	9	
	§4.1.7 - Added note to reference the RHWF Startup Test Program Plan.	9	
	§4.2.1B.7 - Deleted the word “considered.”	11	
	§4.2.1B.13 - Deleted “where practical.”	11	
	§4.2.1C.1 - Reworded for clarity.	11	
	§4.2.1C.2 - Deleted the words “as required”	11	
	§4.2.1C.3 - Changed the word “adequate” to “complete”	11	
	§4.2.2B & C - Deleted references to “high probability of failure.” Combined sentences in section C.	12	
	§4.2.2G - Reworded first sentence for clarity.	12	
	§5.0 - Added subparagraph “I” to clarify that there shall be 15% spare penetrations.	16	
	§5.3 Table - Corrected pressure number.	18	
	§5.4.1 - Changes 5820.2A to 435.1.	18	

WVNSCO RECORD OF REVISION CONTINUATION FORM

Rev. No.	Description of Changes	Revision On Page(s)	Dated
5 (Cont.)	§5.4.1F - Reworded first sentence for clarity.	19	
	§5.4.2 - Corrected code references and added subparagraph A & B to show DOE O435.1 requirements and Submittal requirements.	19	
	§5.5.4B - Reworded to require totally enclosed or TEFC motors for all locations.	22	
	§5.6.2 - Added sentence regarding shield/ airlock door alarms.	24	
	§5.6.4, 1st sentence - Changed ”qualification” To “classification”	25	
	§5.7.4 - Reworded for clarification of the Receiving Area crane use.	26	
	§5.7.5 - Added document number for the Hoisting and Rigging Manual.	26	
	§5.7.7 - Reworded for clarity.	26	
	§5.8.1 - Added statement regarding WVNSCO to provide PRS in the Receiving Area.	27	|
	§6.1 - Added code references.	28	
	§6.2 - Delete reference to QM-3.	28	
	§6.3.1G - Reworded for clarity.	30	
	§6.4.1D - Delete “if required.”	32	
	§6.4.2J.1 - Changed “one hundred” to “100"	35	
	§6.4.2K - Added reference to Subpart H.	35	
	§6.4.5 - Delete note regarding WVDP-177.	38	
	§6.4.5C - Reworded to show type of fire suppression system.	38	
	§6.5.1 - Deleted the words “removed and treated when needed” and deleted the Reference to SOP 300-07.	43	

WVNSCO RECORD OF REVISION CONTINUATION FORM

Rev. No.	Description of Changes	Revision On Page(s)	Dated
5 (Cont.)	§6.5.2 - Section rewritten to include review comments and to describe ANSI N13.1 requirements for the stack sampling.	43	
	§6.5.3 - Added sentences regarding compliance with DOE O435.1 and use of chemicals.	44	
	§6.5.4 - Changed “savings” to “avoidance” and reworded the last sentence for clarity.	44	
	§6.5.4D - Deleted general ¶ concerning waste minimization.	45	
	§6.5.5 - Reworded to clarify groundwater monitoring responsibility.	45	
	§7.2.1B - Changed the word “mounted” to “loaded”	46	
	§7.3 - Corrected pressure and flow for Fire Water.	47	
	§10.1 - Deleted references to the following: ANSI A58.1, ANSI N101.6, ANSI N300, ASHRAE, and NEMA. Added references to the following: ANSI Y14.5, ANSI 6.4, NEMA 1B-1, NFPA 80 and UL 984.	49 - 51	
	§10.1 - Corrected title of ANSI N13.1.	49	
	§10.2 - Added reference to DOE Order 5400.1	51	
	§10.4 - Added reference to Subpart H. Deleted reference to 40 CFR 264.	52	
	§10.5 - Deleted references to: QM-3, SOP 00-41, SOP 300-07, WV-227, WV-918, and WVDP 002. Added references to: SOP 00-30, WVDP-062 and WVNS-TPL-313-001.	53	
	§11.0 - Added reference to WVDP-SAR-023	54	
	Attachment A, Table 1 - Revised data for waste streams #1, 6, 12, and 13.	55	

WVNSCO RECORD OF REVISION CONTINUATION FORM

Rev. No.	Description of Changes	Revision On Page(s)	Dated
6	Per ECN #25001		12/03/02
	Title Page - Changed Cog. System Engineer to Cog. System Manager.		
	§1.0 - Last paragraph reworded for clarity.	1	
	§2.0 - Reworded to more accurately reflect the probable path for processed waste.	1	
	§3.1 - Reworded for clarity.	1	
	§3.6 - Reworded to delete disposal.	2	
	§3.8 - Changed the eight year schedule to six years to be consistent with WVNS-IRP-006.	2	
	§3.9 - Reworded to delete disposal.	2	
	§3.11 - Replaced the word “characterization” with the words “analysis” or “assay.”	3	
	§3.11.1 - Replaced “characterization” with “analysis.”	3	
	§3.11.2 - Added reference to the WVNSCO supplied ISOCS equipment.	3	
	§3.12.1 - Reworded for clarity. Deleted last sentence.	3	
	§3.13 - Reworded to delete disposal.	3	
	§3.16 - Added for completeness.	4	
	§3.17 - Added for completeness.	4	
	§4.1.2 - Reworded to delete disposal	5	
	§4.1.2A - Changed maximum drum weight from 930 lb to 5000 lb to allow for a shielded overpack.	5	
	§4.1.2C - Changed text to reflect RH-TRU drum placement in shielded overpacks.	6	
	§5.1.7 - Added text for silt control.	17	
	§5.4.1A - Delete the word “level” for clarity.	18	

WVNSCO RECORD OF REVISION CONTINUATION FORM

Rev. No.	Description of Changes	Revision On Page(s)	Dated
6 cont.	§5.7.1 - Reworded for clarity.	25	
	§5.7.6 - Reworded for clarity.	26	
	§5.7.8 - Reworded for clarity.	26	
	§6.1 - Added “1999" to ANSI N13.1 to indicate the revision year.	28	
	§6.5 - Changed “characterized” to “assayed.”	42	
	§6.5.1 - Deleted “characterized.”	43	
	§6.5.3 - First paragraph reworded to reflect current plans for liquid waste processing.	44	
	§7.2.1.A - Last sentence reworded for clarity.	46	
	§7.2.1.D - “Characterized” changed to “analyzed”. Last sentence deleted.	46	
	§7.2.3 - Reworded for clarity.	46	
	§7.2.4 - Reworded for clarity.	46	
	§7.2.5 - Reworded for clarity.	46	
	§7.2.6 - Reworded for clarity.	46	
	§7.2.7 - Reworded for clarity.	46	
	§7.2.8 - This section deleted in its entirety.	46	
	§10.1 - Changed ANSI B31.3 & B31.9 to ASME B31.3 & B31.9.	50	
	Attachment A - Replaced Table 1 with updated waste stream data.	55	
7	Per ECN #25503		02/27/03
	§3.4 - Added reference to ion exchange system.	2	
	§3.7 - Entire section rewritten to reflect revised video recording requirements.	2	
	§3.15.1 - Added section for MSM wall plugs.	4	

WVNSCO RECORD OF REVISION CONTINUATION FORM

Rev. No.	Description of Changes	Revision On Page(s)	Dated
7 Cont.	§3.15.2 - Added section for MSM installation and removal system.	4	
	§5.8.1 - Updated information on Powered Roller System scope.	27	
	§5.8.2 - Updated information on Powered Roller System design.	27	
	§5.8.3 - Updated information on Powered Roller System maintenance.	27	
	§5.8.4 - Updated information on Powered Roller System controls.	27-28	
	§6.5.3 - Added description of ion exchange system.	44	
	§7.2.1.C - Added information on heavy haul roadway design.	46	
	§7.2.3 - Added reference to ion exchange system.	47	
	§8.0 - Changed wording concerning the QA Rule and the QA Order	48	
	§10.2 - Updated DOE document revision levels to be consistent with the current contract. Added DOE Standard for Fire Protection Design Criteria.	51 & 52	
	Attachment A - Added updated waste stream data.	55	
8	Per ECN #25597		06/16/03
	Replaced Crane Maintenance Room and Crane Maintenance Area with the term Contact Maintenance Area for consistency.		
	§3.4 - Clarified that WVNSCO will supply the ion exchange system.	2	
	§4.1.7.E - Deleted the requirement for post maintenance load testing of in-cell cranes.	10	
	§5.5.2.H - Added the requirement to install a spare communication cable from the LAN Rack to all racks/equipment fed from the LAN Rack.	22	

WVNSCO RECORD OF REVISION CONTINUATION FORM

Rev. No.	Description of Changes	Revision On Page(s)	Dated
8 Cont.	§5.7 - Clarified the number and locations of in-cell cranes, telescoping masts, and manipulators.	25-27	
	§5.8.2 - Clarified that WVNSCO will supply the structural steel support frame for the Receiving Area PRS.	27	
	§5.8.4 - Deleted the requirement for interlocks between the PRSs and the shield doors.	27	
	§5.9 - Clarified the number and locations of in-cell cranes, telescoping masts, and manipulators.	28	
	§6.5.3 - Clarified that WVNSCO will supply the ion exchange system.	44	
	§7.2.3 - Clarified that WVNSCO will supply the ion exchange system.	47	
	Replaced WVNS with WVNSCO throughout the document.		

TABLE OF CONTENTS

ACRONYM LIST

ALARA	-	As Low As Reasonably Achievable
AMS	-	Alarm Monitoring System
ANSI	-	American National Standards Institute
ASTM	-	American Society of Testing and Materials
AWG	-	American Wire Gage
CH	-	Contact Handled
CMAA70	-	Crane Maintenance Association
CMA	-	Contact Maintenance Area
CPC-WSA	-	Chemical Process Cell - Waste Storage Area
CSS	-	Cement Solidification System
DBE	-	Design Basis Earthquake
DBT	-	Design Base Tornado
DC	-	Design Criteria
DGP	-	Data Gathering Panel
DOE	-	Department of Energy
DPM	-	Disintegrations per minute
EDE	-	Effective Dose Equivalent
EDR	-	Equipment Decontamination Room
EMIP	-	Emergency Management Implementing Procedure
EPA	-	Environmental Protection Agency
ERDA	-	Energy Research and Development Administration
FEP	-	Fluorinated Ethylene Propylene
FHA	-	Fire Hazard Analysis
FRD	-	Functional Requirements Documents
FRS	-	Fuel Receiving and Storage
HEC	-	Head End Cells
HEPA	-	High Efficiency Particulate
HID	-	High Intensity Discharge
HLW	-	High Level Waste
HPS	-	High Pressure Sodium-White
HVAC	-	Heating, Ventilation and Air Conditioning
IAEA	-	International Atomic Energy Agency
IES	-	Illumination Engineering Society
LAN	-	Local Area Network
LLW	-	Low Level Waste
LWTS	-	Liquid Waste Treatment System
MCC	-	Motor Control Cabinet
MMi	-	Man-machine Interface
NEC	-	National Electrical Code
NEMA	-	National Electric Manufacturers Association
NFPA	-	National Fire Protection Association
NYSDEC	-	New York State Department of Environment Conservation
OSHA	-	Occupational Safety and Health Administration

PAO	-	Polyalphaolefin
P&ID	-	Piping and Instrument Drawing
PA	-	Public Address
PLC	-	Programmable Logic Controller
PRS	-	Powered Roller System
Q-List	-	Quality List
RCRA	-	Resource Conservation and Recovery Act
RH	-	Remote Handled
RHWF	-	Remote Handled Waste Facility
SDC	-	Summary Design Criteria
SWB	-	Standard Waste Box
TFE	-	Extruded Polytetra Fluoroethylene
TRU	-	Transuranic
UBC	-	Uniform Building Code
UL	-	Underwriters Laboratory
UPS	-	Uninterruptible Power System
USEPA	-	US Environmental Protection Agency
VSD	-	Variable Speed Drives
WIPP	-	Waste Isolation Pilot Plant
WNYNSC	-	Western NY Nuclear Service Center
WTF	-	Waste Tank Farm
WVDP	-	West Valley Demonstration Project
WVNSCO	-	West Valley Nuclear Services Company
XHHW	-	Cross-Linked Synthetic Polymer

REMOTE HANDLED WASTE FACILITY

1.0 BACKGROUND

The Western New York Nuclear Service Center (WNYNSC) is located in West Valley about 50 km (30 miles) south of Buffalo, New York. It is the site of the only commercial nuclear fuel reprocessing facility ever to have operated in the United States.

The plant was in operation from 1966 to 1972 and during that time generated approximately 2,270 m^3 (600,000 gallons) of high-level radioactive liquid waste.

On October 1, 1980, President Carter signed into law the "West Valley Demonstration Project (WVDP) Act."[1] The Act directs the Secretary of Energy to carry out a high-level radioactive waste management demonstration project at the WNYNSC to demonstrate solidification techniques that can be used for preparing high-level radioactive waste (HLW) for disposal.

Part of the mission of the WVDP is to transport and dispose of Low-Level Waste (LLW) and Transuranic (TRU) waste resulting from HLW solidification; and the decontaminating and decommissioning of the facilities used for HLW solidification, which will generate additional LLW and TRU waste also requiring disposal.

2.0 INTRODUCTION

The Remote-Handled Waste Facility (RHWF) is required to process LLW and TRU waste resulting from HLW solidification. The RHWF is also required to support the decontamination and decommissioning of facilities used for HLW solidification. The RHWF is expected to process the remote-handled waste temporarily stored in the Chemical Process Cell-Waste Storage Area (CPC-WSA). The Facility will handle other potentially high-activity waste streams such as | Waste Tank Farm (WTF) pumps, High-Efficiency Particulate Air (HEPA) filters, shielded LLW, etc.. The processed waste will be ready for transfer to on-site | storage. Mixed, as well as low-activity and low-contamination, waste may also be processed by the same system. The RHWF shall be capable of handling the waste streams listed in Attachment A - Table I.

This design criteria describes the RHWF and its major subsystems.

3.0 FUNCTIONAL REQUIREMENTS

3.1 The RHWF, a stand alone facility, shall size-reduce radiologically contaminated components (e.g., large diameter, multi-layered tanks, piping, structural steel, concrete, wood, herculite, and plastic materials).

3.2 The RHWF shall have provisions for limited decontamination capabilities, which will be used only where it is justified based on cost effectiveness.

3.3 The RHWF shall provide the capability to repair, replace, and decontaminate the equipment, tools, and work area remotely.

3.4 The RHWF shall collect, store, and process secondary waste streams. An ion exchange system, supplied by WVNSCO, shall be installed to provide preliminary processing of liquid secondary waste streams for removal of Cs-137. Final processing of secondary liquid waste shall be in WVDP systems separate from the RHWF. See Section 6.5.3.

3.5 The RHWF shall be capable of stabilizing radioactive particulates, dust, debris, and/or sludges.

3.6 The RHWF shall lift, position, and open containers; remove and replace container contents; and repackage waste streams as they are described in Attachment A - Table I. The processed waste shall be packaged in containers and configurations that meet the physical and radiological acceptance criteria for storage and transportation, which might involve overpacking for high radiation or external contamination conditions (See Attachment A - Table I for weights of waste streams).

3.7 The RHWF shall have the capability to examine via remote viewing (e.g., CCTV cameras, windows, etc.) the different types of waste. The CCTV system shall be capable of recording all waste processing activities from unpacking, segregation, size reduction, to packaging in the final disposal container. The CCTV system shall provide real-time recording of processing activities and shall maintain continual area monitoring to document container integrity.

3.7.1 In addition to real-time recording, the video recording system shall provide advanced video editing features, time-lapse recording, motion sensing/alarm capabilities, and an uninterruptible power supply.

3.7.2 The CCTV system shall provide fixed lens cameras with radiation hardened lenses, as required. The CCTV system shall provide pan/tilt/zoom cameras with motion/light sensors, camera control units, and a time/date generator.

3.7.3 The video recording system shall provide video, audio, and hardcopy records. The system shall provide stand-alone documentation in addition to the WIPP-required supplemental information. The functional requirements for this system are described in WVNS-FRD-034.

3.8 The RHWF shall be able to process the waste streams that are listed in Attachment A - Table I in less than a six-year period. It is assumed that the facility will operate twenty-four hours per day and five days per week or the equivalent thereof during the six-year period. The daily throughput will vary from 5 to 67 cu ft/day, dependent on the waste stream being processed. Note that some of these waste streams potentially contain radioactive mixed waste that must be sorted, segregated and repackaged as appropriate for processing elsewhere.

3.9 The system that handles the waste packages processed in the RHWF shall be able to interface with the on-site and off-site transportation systems. The system shall be able to receive and unload the waste streams listed in Attachment A - Table I. Also, the system shall be able to load the packaged waste for transfer to an interim storage facility.

3.10 The facility design shall minimize cross contamination, either between different contamination zones or different types of waste requiring segregation.

3.11 Preliminary radiological waste analysis will be performed in the Work Cell in order to segregate the waste according to its Low-Level or TRU waste characteristics. This allows for appropriate packaging and for the baseline data to be forwarded to the waste management system.

Radiological assay instrumentation will achieve this preliminary analysis by looking at energies of the different isotopes via a High Purity Germanium crystal detector (HPGe). The HPGe detector coupled with a multi-channel software system, multi-element attenuator assembly, and a computer system will measure the activity of the predominant scaling isotope, Cesium-137. Exposure levels can be adjusted using the multi-element attenuator to analyze the debris within established detection parameters of the HPGe detector. The isotopic information will be used in conjunction with an established waste assay program to estimate the TRU content in nano-curies/gm. Based on this evaluation, the waste is placed in the appropriate container for TRU or LLW and then removed from the RHWF via the Waste Packaging and Load Out Areas. All major components of the preliminary waste assay system shall be located such that they are easily accessible for maintenance and testing operations.

3.11.1 The RHWF shall include a system in the Work Cell to determine the weight of an individual piece of waste and/or a filled waste liner to assist in the analysis of the waste.

3.11.2 An In-Situ Object Counting System will be supplied and installed by WVNSCO in the Load Out Area to provide non-destructive assay of a container before it leaves the facility.

3.12 The RHWF shall have the capability to take smears, bottle samples, cores, and collecting fine particulate, dust, and debris samples from waste, waste packages, floors, walls, and confined spaces and transferring them to glove boxes through a transfer port located inside the RHWF. Although not part of this facility’s functional requirements, the samples will be transferred to on-site or off-site labs for performance of the following analyses:

3.12.1 Radiological analysis to ascertain the concentrations of radionuclides. These analyses are needed to determine the radiological classification of the waste per 10 CFR 61 and to meet the Waste Acceptance Criteria of the designated disposal facility. |

3.12.2 Chemical analysis to determine applicable Resource Conservation and Recovery Act (RCRA) requirements, if any.

3.13 The RHWF shall include a system to determine the exterior contamination levels and dose rates of filled waste packages to ensure they meet requirements for transfer, on-site storage and transportation.

3.14 Hazardous waste, mixed waste, and/or TSCA waste will be sorted, segregated and packaged for processing elsewhere on-site or for shipment off-site for processing. Interim storage will be in other on-site facilities and not in the RHWF.

3.15 Master-Slave-Manipulator (MSM) penetration sleeves, embedments plates for lifting, and 110V power shall be provided to facilitate future installation of MSMs by others.

3.15.1 Wall plugs for the MSM ports on the east wall of the operating aisle shall be provided and shall be designed for equivalent shielding to the concrete shield wall. The plugs shall be designed such that the contamination is minimized during removal and reinstallation operations. The design shall provide an appropriate gap between the penetration sleeve and the plug. The bolt pattern of the mating flange shall be the same as the existing MSM sleeve. The plugs shall be made with materials that can be decontaminated (e.g., SS or carbon steel with Amerlock 400 paint).

3.15.2 The RHWF shall provide an I-beam and trolley system to be used for the installation and removal of all MSMs. The I-beams shall be supported from embedment plates in the ceiling. The headroom requirements shall be consistent with installation and removal requirements for Model F Manipulators supplied by Central Research Laboratory, Red Wing, MN.

3.16 The RHWF shall have a shielding system which provides protection from direct and scatter radiation by the use of structural shield walls and remotely operated shield doors. See Section 6.3.

3.17 The RHWF shall have a radiation and contamination monitoring system. Air exhausted from the facility shall be monitored for radioactive contamination. Occupied spaces shall be provided with contamination and radiation monitors. See Sections 6.3, 6.4 and 6.5.2.

4.0 FACILITY DESIGN REQUIREMENTS

The RHWF consists of the operating cells, areas for loading and unloading waste containers, utilities to support operations, interfaces with external systems, equipment, and monitoring and control systems for operational safety. The RHWF will satisfy the minimum requirements that are imposed on the design and construction of a nonreactor nuclear facility per DOE Order 420.1.

The following philosophies should be the focal point of any effort to design and operate the RHWF: As Low As Reasonably Achievable (ALARA), safety, design simplicity, waste minimization, and ease of decontamination and decommissioning. Therefore, persons involved with the RHWF should consult the Integrated Safety Management and Control of Documents, WV-100, as appropriate.

4.1 Operational Requirements

4.1.1 Operational Requirements (See Section 4.2 for the requirements to perform some of these operations remotely.):

A. Receiving containers and waste from other locations on site.

B. Handling containers, vessels, and pieces of equipment of various weight and geometry (see Attachment A - Table I).

C. Visual inspection of various shaped containers, vessels, and pieces of equipment during processing.

D. Opening different containers, dewatering containers and the waste within the containers, removal of the container’s contents, and the segregation of the container’s contents.

E. Size reduction of containers, container contents, vessels, and pieces of equipment of various weight, density, and geometry (see Attachment A - Table I).

F. The facility shall be capable of dispositioning of emptied containers, including decontamination, overpacking or segmentation.

G. Collecting radiological data on various waste and container contents.

H. Collect and transfer samples for radiological and chemical analysis of various wastes and container contents.

I. Decontamination of facility and system equipment (e.g., overhead cranes, manipulators, remote tooling, etc) to allow hands-on maintenance of equipment.

J. Laydown areas for waste awaiting sample results or waste awaiting loading into a shipping container.

K. The Work Cell shall be provided with storage racks that are accessible by the jib or overhead cranes for the temporary storage of waste and waste container liners. Different waste material types shall be kept segregated.

L. Changeout of prefilters and HEPA filters.

M. Handling effluents, solids, liquids or gas that may be generated during normal evolutions.

N. Repackaging wastes into containers.

O. Decontamination, overpacking and/or shielding of packaged waste containers to meet shipping requirements.

P. Detection, containment, collection, and removal of liquids.

Q. Loading packaged waste on designated vehicles for transfer to interim storage or shipment.

R. Disposition of samples, if required.

4.1.2 Packaging and Transportation

Processed radioactive material shall be packaged in containers and configurations that meet the physical and radiological requirements for storage and transportation. The following assumptions shall be incorporated into the design:

A. Use standard size 55-gallon drums (5000 lb maximum including a shielded overpack) and 4'x4'x6' B-25 boxes (11,000 lb maximum) for shipment and transportation of LLW, meeting the requirements of NTS and/or Hanford DOE for Class B and C LLW or Envirocare for Class A LLW only.

B. Use standard size 55-gallon drums and Standard Waste Boxes (SWB) meeting the requirements of the Waste Isolation Pilot Project’s (WIPP's) waste acceptance criteria and 49 CFR for shipment and disposal of Contact-Handled (CH)-TRU waste.

C. Use standard 55-gallon drums for temporary storage of Remote Handled (RH) TRU waste. These 55 gallon drums will be individually placed in shielded overpacks in the RHWF to allow on-site transfer to an interim storage location. The drums will be loaded into RH-TRU shipping casks by WVNSCO at a later date.

D. As a special case, use S-144 boxes (weight limit varies) for shipment and disposal of LLW.

E. A waste transfer system will be used to transfer packaged waste from inside the Work Cell into a standard container for storage or disposal. Because of the potential of high contaminations inside the cell and the presence of TRU waste, a double lid type transfer system is recommended.

F. S-144 waste boxes will not be processed through the waste transfer system. A wrapped liner will be introduced into the Work Cell, then a wrapped S-144 box will be placed in the Buffer Cell. Waste will be placed in the wrapped liner. The wrapping will be stripped off before moving the liner back into the Buffer Cell. The liner will be moved to the Buffer Cell and placed inside the S-144 box. The box wrapping will be stripped off, and the box will be transferred out of the Buffer Cell back through the Receiving Area.

G. The waste transfer system will have the necessary provisions for decontamination. Washdown capabilities and drains must be provided as necessary to facilitate decontamination.

4.1.3 Sampling and Laboratory Analysis

Sampling and laboratory analysis and/or monitoring will be provided by WVNSCO to the extent necessary to safely control process operations and to provide the data to satisfy the documentation requirements for each waste form. |

A. The RHWF shall be capable of collecting and transferring samples for performing, at a minium, radiological and chemical analyses, for the purpose of meeting transportation and disposal requirements including the specific requirements of the disposal facility.

B. The following analytical facilities are potential interfaces with the RHWF:

1. It is currently planned that samples will be analyzed in the existing Analytical and Process Chemical Laboratory, to the extent it is available.

2. The RHWF will be designed to interface with a modular-type lab attached to the RHWF. Although not initially part of the RHWF, the extent and complexity of this lab is contingent on the extent of the analysis that will be done on site.

3. Off-site laboratories.

C. The equipment inside the Work Cell and contaminated areas will be capable of performing the following functions remotely:

1. Local (remote) survey to determine radiation and contamination levels.

2. Taking and transferring samples to designated areas for analysis or preparation for shipping; this shall include capabilities for taking smears, bottled samples, core drills, and the collection of fine particulate, dusts, and debris samples from waste, waste packages, floors, walls, and confined spaces.

3. Taking and transferring liquid samples from the drain collection tank.

4.1.4 Security Requirements

A. Security alarm and monitoring systems shall provide input to and be compatible with the WVDP Security alarm system. The security alarm and monitoring systems shall include: phone lines, computer cables, CCTV cables, fire alarms, emergency alarms, 812 All page, Plant paging and intercom systems.

B. The RHWF shall be designed with the minimum number of external access points, as dictated by safe and efficient access and egress. Access shall be limited to authorized personnel.

C. Locking and alarming appropriate cells and access doors to the process cells shall be considered and used as appropriate to further enhance security.

D. Computer systems are to be password protected.

4.1.5 Human Factors Engineering Requirements

The facility shall be designed to be comfortable and natural for personnel to operate and maintain. Human factors shall be considered in positioning equipment, switches, valves, and instruments from both an operating and a maintenance viewpoint. The following shall be considered:

A. Instrument readouts shall be located at average eye elevation for ease of reading. The instruments controls shall be located to permit visual monitoring without drastic shifts of body position.

B. Equipment shall be accessible for ease of operation and maintenance.

C. Valves shall be properly sized and located for ease of operation without using ladders, platforms, or over extending the body beyond normal reach.

D. Manipulators and viewing equipment shall be properly located for ease of remote operation and maintenance.

E. The accommodation of operators with a range of physical sizes and ability.

F. Minimizing or automating operations requiring special skills or special attention.

G. Audible and visual alarms that warn operators in advance of conditions exceeding limits.

H. Maintaining communications systems during normal and off-normal operating conditions (e.g., emergency communication systems such as the "812" All Page, intercoms, and hand-held radios). Radios will be supplied by WVNSCO. Space shall be allowed for a base station, antenna and charging station.

I. System control, display devices, component arrangement, vibration, noise, lighting, emergency lighting, ventilation, temperature, humidity, human dimensions, protective equipment, warning and annunciator systems, and maintainability shall be considered in the control station design and layout.

J. Storage areas for equipment (located in appropriate locations).

K. Provisions shall be included inside the RHWF and/or in the office area for personnel accommodations (e.g., shift supervisor’s office, meeting room, men’s and women’s restrooms) based on a shift crew size of 16. The restroom facilities shall be handicap accessible. (See other sections of this Design Criteria (DC) for human factors issues specific to these areas.)

4.1.6 Cleanliness

Consideration shall be given to facility and process system cleanliness during construction and operation. Typical examples of provisions to allow easy maintenance of the facility include:

A. Personnel access around equipment for cleaning.

B. Areas for storing cleaning equipment.

C. Temporary filters on air-cooled equipment that will be operated/tested under construction conditions when there may be abnormal amounts of dust in the air.

D. Connections to support the flushing of fluid systems.

E. Areas for storing recyclables and segregated wastes. An air dryer and/or filters may be required to mitigate anticipated water/dirt in compressed air lines.

4.1.7 Testing

Components and systems will require testing and/or troubleshooting during construction, following construction, and after the plant is operational. Test requirements shall be considered during design. Provisions for accomplishing them, such as electrical and piping connections, valves, plugs, etc., shall be included to accommodate test activities. For clarification, typical examples may include:

A. Sufficient monitoring points for checking pressure, differential pressure, flow rates, and flow path. Where pressure-indicating devices are not permanently installed, plugged pressure taps should be provided.

B. Calibration points for pneumatic systems.

C. Provisions for power supply testing, polarity checks, and the ability to confirm the compatibility of instrument signals from detector to readout.

D. Methods for hydrostatic and pneumatic testing of piping systems and vessels.

E. Provisions to permit load-testing of cranes and hoists after installation. After processing operations, radiation and radioactive contamination will cause certain areas of the facility to become hostile environments that prevent completion of standard crane maintenance and test procedures, such as load testing. This will be documented by a Hostile Environment Plan (Exhibit I), in accordance with WVDP-082, WVNSCO Hoisting and Rigging Manual.

F. Special jumper(s) for testing.

G. Testing of stack monitoring and its sampling system.

H. Shield integrity.

I. The design shall provide a means to establish differential pressure and contamination level reference points for the HEPA filters.

Note : Details related to startup testing can be found in WVNS-TPL-313-001, RHWF Startup Test Program Plan.

4.2 Remote Handling and Maintenance Requirements

4.2.1 Remote Handling Requirements

The systems in the RHWF will be designed for remote operations and maintenance. For the RHWF, remote changeout is used to denote remote replacement, and remote maintenance is used to denote in situ maintenance.

A. Equipment and Waste

1. Installation of remotely removable jumper assemblies will be used in the shielded RHWF Work Cell to enhance remote changeout. Jumpers should be designed with the capability for adjustment for fit-up. Remote connectors shall be reliable, but easy, to use. Note that “PUREX” connectors are not necessarily required.

2. Equipment (e.g., sump pumps, samplers, exhaust filters, local exhaust blowers, cutting tooling, motors, and electrical components) located in the shielded RHWF Work Cell will also be designed to permit remote replacement. Space shall be provided for equipment removal, with the reasonable disassembly and removal of adjacent equipment.

3. Special handling fixtures or devices required to handle empty or filled waste containers will be incorporated into the design. This equipment should be simple, reliable, and attach directly to the crane hook.

B. Design

To provide adequate remote capabilities, certain design features shall be provided:

1. During transfer of radioactive items and materials, personnel radiation exposures shall be maintained ALARA. The viewing of routine remote operations shall use normal window viewing angles. Where viewing through a window is not feasible, closed-circuit TV with movable in-cell support assemblies shall be provided using existing technologies.

2. Operational and maintenance requirements shall be considered for remote process equipment accessibility.

3. Work Cell mechanical and electrical equipment (windows, TV, manipulators, electrical enclosures, etc.) shall be sealed or otherwise protected from water.

4. Work Cell lights shall be remotely replaceable.

5. Tool storage areas and work tables shall be provided in the cell to support remote maintenance requirements.

6. Retrieval systems for remote in-cell cranes and manipulators shall be provided for both normal and off-normal conditions.

7. Dedicated operating or maintenance areas shall be provided and defined on arrangement drawings. The field run of installed equipment, such as piping, electrical, instrument, or Heating, Ventilation, and Air Conditioning (HVAC) shall not violate a dedicated space. Dedicated space shall be made available for remote manipulator operation as well as insertion and removal.

8. Connectors, bolts, flanges, wrenches, sockets, extensions, etc., shall be standardized to the maximum extent practical to reduce the need for multiple tools and frequent tool changes.

9. Equipment shall be removable, maintainable, and replaceable with the minimum disturbance of adjacent equipment.

10. Modular equipment, component, and subsystem designs shall be used where possible to facilitate removal and replacement. Special attention should be paid to the design of guide pins and remote fasteners.

11. In-cell equipment "sky-rights" shall be provided to ensure accessibility with overhead handling equipment. In addition, visibility, accessibility, and interferences must be considered during design.

12. Developmental or unproven state-of-the-art items are unacceptable unless the concepts/equipment are able to be proven by remote mockup prior to incorporation into the facility design. In addition, remote tooling and equipment shall be maintained as practical, straightforward, and simple as possible. Standardization (sizes, shapes, arrangement) shall also be maximized.

13. Parts and components shall be designed for easy decontamination.

C. Facility Requirements

To accomplish remote requirements, the RHWF shall include the following features:

1. Sufficient numbers of embedment plates for the installation or replacement of viewing windows, remote manipulators, and cell doors.

2. Cell access through hatches.

3. Bridge crane(s) to provide complete cell coverage.

4. Control stations for the in-cell crane(s) and power manipulators should be located adjacent to viewing windows to permit local remote operation.

5. Dedicated areas that can be isolated from the Work Cell (e.g., for crane maintenance, see 4.2.2).

6. A dedicated area with viewing window for radiation survey, sampling and sample preparation.

7. Transfer drawers or drop tubes for passing sampling media and tools into the Work Cell.

D. Remote Equipment

In-cell remote handling equipment shall be provided with redundant features and/or retrieval systems to facilitate recovery from failures.

4.2.2 Maintenance Requirements

A. A dedicated area shall be provided for parking and decontamination of the Work Cell cranes, and subsequent contact maintenance. |

B. Components that require routine maintenance shall be located outside the remote areas to the maximum extent possible.

C. Spares shall be provided for components such as seals, motors, gaskets, pumps, electronics, TV cameras, lights, and crane and manipulator components. The use of existing equipment should be considered due to existing spare parts and repair knowledge.

D. Spare wall penetrations shall be provided for passing through hoses, cables, and tools.

E. Cable carrier systems for the Work Cell cranes should be designed to protect the cable and cable connectors from damage. They should include spare cables/conductors. Special provisions are required for remotely replacing crane cables. |

F. Mechanical and electrical systems shall be designed so preventive, corrective, and predictive maintenance can take place on primary and backup power without compromising safety or environmental protection.

G. Isolation capability (specifically for locking and tagging) and redundant equipment shall be provided to permit maintenance without interrupting services. Consideration should be given to optimizing the number and location of locks and tags to facilitate maintenance outages with minor disruption to operations.

H. Special tooling, fixtures, or handling devices required to maintain or replace remote handled equipment will be incorporated into the design.

I. Access (e.g. through floor/roof hatches, by removing side wall panels, or through air locks) shall be provided for the insertion of remote handling equipment and replacement parts such as trolleys, hoists, telescoping tubes, and master slave manipulators into contact maintenance areas. | |

4.3 Decontamination

The RHWF systems and structures are to be designed to facilitate post waste processing decontamination. This includes decontamination of the structure and equipment, and removal of sources of hazardous and radioactive materials to acceptable levels or concentrations.

4.3.1 In-Cell Decontamination

The RHWF decontamination system shall permit flushing the surfaces of piping and equipment in contact with contaminated liquids and solids.

The RHWF shall include features to reduce the duration and frequency of decontamination efforts:

A. Process piping design shall minimize nondraining low points or pockets. Where low points or pockets are unavoidable, provisions shall be required to drain or flush them.

B. The vessel design shall enhance the complete removal of process and decontamination solutions. Interior and exterior crevices shall be minimized.

C. Horizontal surfaces are to be avoided. Sloped surfaces are to be utilized to facilitate the drainage of decontamination solutions.

| D. Cell floors (i.e., the Buffer Cell, Work Cell, Contact Maintenance Area (both levels), Waste Transfer System, Packaging Area, and Drain Tank Collection Vault) shall be stainless steel lined. Cell walls shall also be stainless steel lined to a height that satisfies the requirements of 6 NYCRR and what is deemed appropriate for the facility. Surfaces that are not stainless steel lined shall be protected with other appropriate decontaminatable coatings (e.g., epoxy coatings).

E. Cell floors shall be adequately sloped for drainage and shall include a means of decontaminating the sump areas. Liquids will be transferred from the sump area to a collection tank using pumps or an equivalent means.

F. Items such as utility piping, conduits, instrument tubing, and ductwork should be kept to a minimum in potential contamination areas or should be covered to facilitate decontamination.

| G. The Work Cell and Contact Maintenance Area (CMA) shall be provided with remote, wash-down capabilities to wash
| down the cranes and the manipulators in order to reduce
| the dose rate and contamination levels on the cranes and manipulators before and after they are moved to the
| Contact Maintenance Area. Also, wash-down capabilities
| will be provided for decontamination of the cell floors,

walls, and major equipment either for future decontamination and decommissioning or, if it is required, during the operation phase. The decontamination water supply line will be equipped with a flow indicator and totalizer to provide the quantity of water used for decontamination. |

H. Corrodible structures or surfaces, such as exposed carbon steel, shall be covered with protective, decontaminatable coatings.

I. Air locks shall be stainless steel lined or the surfaces shall be epoxy-coated in multiple layers that are smooth and continuous.

5.0 STRUCTURAL, EQUIPMENT, PIPING, AND ELECTRICAL REQUIREMENTS

The RHWF systems and components will use the existing plant utilities to the maximum extent possible. New utilities will be provided when existing utilities are inadequate, unsatisfactory, or not available. The RHWF will provide means for distributing utilities to or from the systems or components requiring them. The RHWF shall have a minimum of 15% of additional capacity for all utilities; except, the HVAC exhaust systems designed in accordance with ERDA 76-21 standards shall have 33% additional capacity. The additional HVAC capacity will be reserved for excess infiltration of air. |

A. The following site criteria for installing underground utilities should be followed:

1. Electrical lines will be installed in accordance with NFPA-70.

2. Storm drainage lines will be designed to withstand an H-20 highway loading.

3. Any utility line susceptible to freezing will be installed a minimum of 42 inches below grade.

4. Potable water lines will be separated a minimum of 10 ft horizontally and 2 ft vertically from sanitary sewer lines, unless special concrete encasement is utilized.

5. Natural gas lines will be installed per National Fuel Gas Code NFPA 54 and ANSI Z223.1, and will be installed with a metal wire tracing system.

6. Potable water lines will be disinfected per local health code requirements.

7. Communication lines will be installed in rigid, galvanized conduits.

B. Utility stations that include at least utility air, utility water, and instrument air will be provided in the Buffer Cell, Work Cell, Contact Maintenance Areas, Operating Aisles, Receiving and Load Out areas. |

C. Structures that are not required to confine radioactive material shall be designed to the New York State "Manual for the State Building Construction Code" and the Uniform Building Code (UBC) code.

D. Structures and components that are required to confine radioactive material that could be hazardous to the public or site personnel, shall be able to withstand the effects of natural hazards (see Sections 5.1.1 through 5.1.8) without loss of their capability to perform their safety function(s) or prevent the release of radioactivity. They shall be designed to DOE Order 420.1.

E. Design features of the RHWF shall meet the requirements of a containment building as specified in 6 NYCRR 373.3-30(b).

F. Design floor loads are as follows:

1. Flat Roofs: 40 psf (snow load) + roof dead load + additional dead load required per the design.

2. Floors in office and process areas and operating aisles: 100 psf (live load) + dead load and additional dead load required per the design.

3. Floors on grade in loading and unloading areas: 300 psf uniform loading and 10,000 psf concentrated load

4. Foundation should be under the frost level (minimum 42 inches deep - NFPA 24)

G. Special attention should be paid to door openings, aisle widths, head room clearance, etc., needed for moving objects into and out of the RHWF, and specifically the Work Cell. The design should account for the different fork lifts, trucks, tractor-trailers, waste containers, and packages (see section 4.1.2 etc.). The shield doors are the normal routes for bringing equipment and waste in. The waste transfer system or through the shield doors for box liners going back to the Buffer Cell will be the normal routes for bringing objects out of the Work Cell (See Sections 5.7.9 and 5.7.10 for small components). Special provisions will be made to accommodate equipment that is difficult to transport using normal means. Examples of special provisions would be hatches in the walls or the roof, or the need to utilize the modular units.

H. The RHWF shall be designed for potential expansions through the addition of modules. Expansion of the RHWF with modules shall be by means of removable shield and barrier walls.

I. The RHWF shall have a minimum of 15% spare penetrations for all piping and conduit runs.

5.1 Natural Hazards

5.1.1 Design Basis Earthquake (DBE)

The Design Basis Earthquake (DBE) was established by the "Seismic Hazard Analysis for the West Valley Demonstration Project"[3] and approved by "Seismic Hazard Analysis" [4]. New

confinement structures shall be designed to an acceleration of 0.1 g at ground level (horizontal loads). The design shall be verified by analysis or testing.

Earthquake loads and evaluation used in the design shall be, at a minimum, in accordance with UBC, 1991 edition for Zone 1, modified with an importance factor of 1.25.

5.1.2 Design Pressure Differential

Concrete building structures shall be designed to withstand negative pressures with respect to the outside atmosphere. The off-normal interior design pressure shall be a negative 2487 Pa (-10 inches H_2O) which bounds the credible negative pressure that the HVAC exhaust fans can pull on the HVAC system, concrete building and associated structures.

5.1.3 Design Wind Forces

Building structures, and equipment on the exterior of the buildings, shall be designed to 100-year wind of 35.8 m/s (80 mph) with a gust response factor of 1.21. Wind pressure shall be analyzed using the methods specified in ANSI A58.1, Exposure Condition C.

5.1.4 Design Snow Loading

Buildings and outside structures shall be designed for a snow load of 1,915 Pa (40 lb/ft^2).

5.1.5 Design Rainfall

Intense rainfall is not considered to be a hazard to the facility and will not result in releases of radioactivity to the environment.

The facility will be designed to incorporate an industrial roof system, with a minimum 20 year life, and will incorporate industrial means and methods for waterproofing and sealing to prevent the intrusion of intense rainfall.

Storm drainage around the facility will be designed to accommodate rainfall intensity for a 100-year storm event such that backup of storm water will not flow into the facility.

5.1.6 Reference Design Flooding

A flood is not considered to be a hazard to the facility and will not result in releases of radioactivity to the environment. Also, the RHWF will be designed so that groundwater intrusion into the facility shall not occur.

5.1.7 Surface Water Run-off

During construction, surface or storm water run-off will be diverted away from the open excavation to the extent that is practical. Following construction, storm water run-off from the building and adjacent area should utilize existing drainage features (i.e., ditches, swales, culverts, outfalls, etc.) to the maximum extent practicable. Hay bales and silt screen may be used for runoff silt control as needed.

5.1.8 Subsurface Geology

The design should consider subsurface geologic conditions (i.e., depth to the Lavery till). This geologic unit provides a natural barrier to downward migration of potential contaminants. The design should minimize any disturbance to the Lavery till during excavation and should preclude the use of support structures that would fully penetrate its thickness.

5.2 Design Life

The equipment shall have a service life of 20 years. This will provide time for cold testing and checkout, as well as operational time.

The service life for remote equipment may be met by: 1) designing quality and reliability into the equipment; 2) specifying redundant backup equipment; and/or 3) designing the equipment for replacement.

5.3 Equipment Environment

Environmental conditions and radiation exposure shall be taken into consideration in the design of the equipment.

Environmental design consideration shall be based on the following conditions: temperature, humidity, pressure, abrasives, etc. affecting the particular equipment.

The following values can be used as general guides for the conditions inside the Work Cell:

Environmental Conditions	
Temperature, EF	70 ± 20
Relative humidity	20% to 80%
Pressure, inches of water	-1.5 ± .25

Radiological design considerations shall be based on the total radiation (exposure from all radiation sources) affecting the particular equipment. For all organic or elastomeric material exposed to greater than 1.0 * E6 rads total integrated dose (Teflon 1.0 * E4 rads), the following shall be evaluated: 1) use of another material, 2) use of local shielding, and/or 3) the design of the particular equipment for ease of replacement, cleaning, or decon.

5.4 Piping

The piping shall be designed and built in accordance with ANSI B31.3 or ANSI B31.9 with the following additions:

5.4.1 All applicable parts of DOE Order 435.1(Radioactive Waste Management) shall be implemented in the design with emphasis on the following points:

A. A second containment shall be provided for all high activity liquid waste lines that are exterior to the shielded cell(s).

1. The containment shall be in the form of a double-wall piping system.

2. All inner pipe welds for double-wall pipes and 5% of the outer pipe welds shall be inspected by radiographic or ultrasonic examination in accordance with ANSI B31.3.

3. The volume between the containments shall be monitored for possible leaks, using feasible technology (e.g., moisture detection).

B. Non-destructive examination requirements for piping systems shall be per ANSI B31.3 or ANSI B31.9.

C. Openings through cell walls such as holes, blockouts, etc., must be sealed to allow HVAC balancing.

D. Where "line slope" and "avoidance of pockets" are essential, this information must be included on the drawings.

E. Bolts, flanges, nuts, externals, etc., used with stainless steel valves and piping must also be stainless steel, unless material is evaluated per Section 5.3 and found acceptable.

F. Piping systems that penetrate the Zone I airlock as defined in section 6.4.1.C boundary, shall be designed to prevent the backflow of solution from contaminated to clean areas. That design shall consider elevational differences, pressure differentials, siphon breaks, check and isolation valves as close as possible to the cell wall, and line flushes or air purges to prevent spreading contamination through facility piping.

G. Double block and bleeds are required on lines that connect to existing utilities to provide isolation of the RHWF from other facilities.

H. Piping components (e.g., valves, orifices, strainers, relief devices, etc.) must be shown on the Piping and Instrument Drawing (P&IDs). Each component will require an individual number.

I. Standardize piping components (e.g., valves) wherever possible.

J. Drain lines should be protected with strainers/filters to prevent solids from entering these lines. Provide the capability to flush/back flush these lines to prevent/mitigate the accumulation of solids. Traps, seals, or removable plugs are to be provided to prevent back flow of contaminated air from the drain collection system or cross flow of contaminated air between cells.

K. All natural gas piping shall be routed outside of the RHWF. In addition, the natural gas heating portion of the HVAC systems shall be located outside.

5.4.2 Tank systems (including piping) external to the RHWF Work Cell shall comply with the requirements of 6 NYCRR 373.3-10(c)[40 CFR Parts 265.192]including secondary containment. Internal and external drainage systems shall permit monitoring, collection, and treatment. A secondary containment system for vessels containing liquids must have sufficient capacity to contain 110% of the volume of the largest vessel (Ref: 6 NYCRR 373 - 3.9 (f)(1)). Upon completion of the following items, the supplier is required to submit documentation to WVNSCO for approval:

A. New tank systems must have independent, qualified, registered PE assessment for structural integrity and acceptability for storing/treating hazardous waste.

B. Independent PE inspection is required prior to placing new tank systems into service.

5.4.3 In case hydraulic lines are used as part of the piping system, then credible analysis will be performed to mitigate any serious problems that might arise due to water hammer.

5.5 Electrical

Electrical systems shall be designed to NFPA 70, National Electric Code (NEC), and be in sufficient detail for a safety evaluation and the preparation of installation, operational, and maintenance procedures.

Electrical power single-line diagrams for loads that are controlled from a motor control center (MCC) (if used) shall be generated. Loads from 208/120V power or lighting panels shall be shown in a power panel schedule format. Control schematic diagrams shall be generated to show the functional operation of a system or equipment (i.e., motors).

In-cell junction boxes, motors, connectors, etc. need to be watertight/waterproof and have as few cracks and crevices as possible so that both decontamination and surveying is easier and more effective.

5.5.1 Raceways

A. Cable trays shall be considered for large multiple cable applications. When used, power, control, and instrument cable trays shall be arranged from top to bottom, respectively, when routed in the same area.

B. Galvanized rigid steel conduit shall be used in locations classified as industrial or hazardous by NFPA, and electrical metallic tubing shall be used for nonhazardous, noncorrosive, or non-industrial locations.

C. Flexible, liquid-tight steel conduit shall be used for connections to equipment subject to vibration. Flexible steel conduit shall be used from junction boxes to recessed lighting fixtures.

D. In-cell electrical conduit shall be stainless steel pipe with welded connections, with the exception of electrical jumpers. The conduit shall be sealed to ensure the integrity of the HVAC pressure zones.

E. Raceway loading shall meet the NEC.

5.5.2 Conductors

A. Power, control, and instrument conductors shall be copper. Other instrument conductors shall be as required to meet applications (e.g., thermocouple conductors).

B. Power and control conductor insulations shall be 90 degree C, 600-volt, NEC-type XHHW. Instrument conductors shall be 90 degree C, 300 volt, NEC type XHHW. Conductor insulation in high-temperature area shall be NEC-type FEP or TFE as required.

C. Power, control, and instrument conductor stranding shall be ASTM B8 Class B stranded. Other special applications may require an extra stranding conductor to meet the desired application (i.e., welding cables or crane cables).

D. Conductors for power and lighting branch circuits shall not be smaller than No. #12 AWG.

E. Instrument cables shall have overall pair shielding to prevent signal interference.

F. Conductor identification shall be as follows:

1. For 240/120 volt, 1-Phase System

Hot	Black
Hot	Red
Neutral	White
Ground	Green

2. For 480/277 volt, 3-Phase System

Phase A	Yellow
Phase B	Orange
Phase C	Brown
Neutral	Gray
Ground	Green

3. For 208/120 volt, 3-Phase System

Phase A	Black
Phase B	Red
Phase C	Blue
Neutral	White
Ground	Green

G. Allow 20% spares at a minimum when multiple power, control, and instrument cables or circuits are routed through raceways and when multi-conductor cables are used (i.e., 5 circuits through one conduit, add 1 circuit spare; or 5-pair cable, add 1-pair spare).

H. Install spare communication cables between the LAN Rack and PLC-1/PLC-2 and all interconnected racks/equipment. The cables should be terminated with the proper connectors and labeled with the same cable numbers as the main cables, with the addition of the word "Spare".

5.5.3 Transformers

Transformers for power and lighting shall be the dry-type and meet NEMA ST 20.

5.5.4 Motors

A. Motors shall comply with NEMA MG-1, except that hermetic refrigerant motor compressors shall comply with UL 984.

B. Motor enclosures shall be totally enclosed or totally enclosed fan-cooled for all locations.

C. Motors shall have sufficient rating for the duty they are to perform and shall not exceed their continuous horsepower rating, excluding the service factor, when the driven equipment is operating at its maximum horsepower. Starting and running characteristics shall be coordinated with the driven machine and the motor control equipment. High-efficiency motors shall be considered where loading and constant usage may result.

D. Variable Speed Drives (VSD) shall be considered where motor speed requirements vary widely during normal operation. Solid state VSD units are recommended for smaller horsepower motors. The driven motors shall be sized to match the VSD, to avoid over-heating the motor.

5.5.5 Control Panels and Stations

The Operating Aisle, for most part, is the control room for the RHWF.

A. Motor controls shall comply with NEMA ICS.

B. Three-phase motors controlled automatically and motors greater than 1 shall have magnetic starters, unless a VSD is used.

C. Reduced voltage or softstart shall be provided for larger motors where starting the motor may result in an unacceptable voltage dip, unless a VSD is used.

D. Control panels shall be assembled with NEMA-rated components.

5.5.6 Uninterruptible Power System (UPS) and Batteries

A. UPS power shall be provided for equipment that can not sustain functions because of momentary power loss. The UPS must provide 30 minutes of full-rated load of power to the instrument and controls required to allow monitoring and prevent shutdown of the HVAC System.

B. Storage batteries and the battery charger shall comply with NEMA 1B-1 and NEMA RI-2, respectively. (See 6.4.2 O. for UPS room ventilation requirements).

5.5.7 Lighting

A. Emergency and exit lighting shall meet NFPA 101.

B. Normal lighting shall meet IES Lighting Handbook standards.

C. Interior lighting shall be fluorescent for normal lighting and HID (High-Pressure, Sodium-White) for high-bay lighting.

D. Exterior lighting (wall pack’s (HPS)) shall be provided and mounted on the external structure of the building to provide perimeter and access lighting. Exterior lighting shall meet IES Lighting Handbook Standards.

5.5.8 Lightning Protection

A. Lightning protection shall comply with NFPA 780.

5.5.9 Grounding

A. The grounding system shall be separate for power and instrumentation grounds and shall meet NFPA 70.

B. The ground rods shall be driven into the perimeter of the facility and connected to grounding loop to reduce the resistance to ground as low as 10 Ohms or less.

C. Raceways shall not be used as a ground path.

D. All boxes, enclosures, motors, and cabinets shall be separately grounded.

5.5.10 Electrical Heat Tracing

Where electric heat tracing is used, the heat tracing shall be the self-regulating, thermostatically controlled, Raychem-type.

5.6 Instrumentation and Control

5.6.1 Instrumentation

A. A process and instrumentation diagrams shall be generated to represent piping, ductwork, equipment, instrumentation, and controls showing the functional relationship between the various components.

B. Functional logic diagrams shall also be generated to show the graphic presentation and logical design of the individual system(s) controls, including inputs/outputs as required.

C. Control systems shall be designed to be fail-safe.

D. An electronic system and man-machine interface (MMI) for control, monitoring, and data acquisition, using the latest proven commercially available technologies, shall be used in the facility.

1. MMI will be located in control stations.

2. The MMI shall be user friendly and free of electrical or magnetic signal interferences.

3. Space, cabling, and power will be provided to support installation of WVNSCO's PC-based integrated waste tracking system. This PC terminal will not, however be connected to the RHWF PLC/PC control system.

Instrumentation shall be used to provide automatic or manual control of all controlled equipment and facility parameters. It will also be used to monitor the HVAC system, safety and fire protections systems, radiation monitoring systems, and

environmental monitoring systems. Instrumentation shall be selected on the basis of their applicability, simplicity, reliability, and availability, and shall be standardized whenever possible to simplify the spare parts inventory. Sensitive instruments and devices shall be designed to mitigate electrical and magnetic signal interferences. Instrumentation shall read out in English units of measurement.

5.6.2 Alarms

Alarms shall be provided for the safety systems, shield/airlock doors, HVAC system, rad monitoring system, and environmental monitoring system of the RHWF, and shall be alarmed in the control station. The centralized alarm system shall provide a display of the RHWF alarms. The shield/airlock door alarms shall be designed so that they may be overridden based on changing operational requirements in the future.

The alarms shall be set to provide warning when the system is off-normal, but still provide sufficient response time to respond to or correct the off-normal condition.

All alarms shall be fail-safe with contacts opening to alarm so that broken wires will be indicated as a circuit fault rather than preventing an alarm.

The alarms will not only be displayed in the RHWF alarm display, but will be tied into the plant alarm system and Security's Alarm Monitoring Station (AMS) where required.

5.6.3 Radiation Exposure

All instrumentation located in a radioactive environment shall be subject to the considerations of Section 5.3. These instruments shall be retrievable for repair or replacement. Wherever possible, human interface points will be located in nonradiation areas. Only the instrument-sensing device shall be in the high-radiation field. The transmitter or mechanical device shall not be located in a radiation/contamination area.

5.6.4 Accuracy

The accuracy of the monitoring systems or laboratory analysis will be sufficient to provide the information required to operate the process safely and to provide the data for documenting the waste classification requirements. Calibration procedures will be developed to ensure the specified accuracies are obtained and maintained. The environmental monitoring system must meet the requirements of WVDP-098, SOP 00-41, EMP-300, and EMP-301.

5.7 Cell Cranes and Doors

5.7.1 Bridge cranes shall be provided in the RHWF Work Cell and in the Receiving Area. Two cranes will be provided in the Work Cell. One Work Cell crane will be provided with two telescoping tubes, each equipped with a power dexterous manipulator. The telescoping tubes shall be rated for a 3 ton lift. The second work cell crane will be provided with a cable hoist rated for a 30 ton lift. The Receiving Area bridge shall be equipped with a cable hoist rated for a 20 ton lift. Also, a wall mounted jib crane with a power dexterous manipulator at its end will be provided in the Work Cell. The cranes will be used for everyday operations such as container and waste handling, sampling operations, equipment removal, and high-capacity lifts.

5.7.2 The Work Cell cranes will be retrievable back to a dedicated maintenance area in the event of a failure. In meeting this requirement, consideration shall be given to the use of dual, independent bridge drives.

5.7.3 Local, computer-based control stations will be provided for operating each Work Cell crane. Work Cell crane control stations will be located at the shielded viewing windows and should be movable from window to window and should be PLC-based (solid-state) as opposed to relay-based. The control box and plug-in need to be small and ergonomic. All crane controls shall be ergonomically designed so that the cranes can be operated by an operator while viewing any area of the cell through the cell windows.

5.7.4 The Receiving Area crane will be radio controlled and can be used as a back-up for the Work Cell crane. Arrangements will be made so that the radio control station can be used at the shielded viewing windows to operate the Receiving Area crane. Note that the Receiving Area crane will be available as a backup for the Work Cell crane, not as a replacement. The cranes do not share identical capabilities.

5.7.5 The RHWF crane(s) will be designed and tested in accordance with crane standards CMAA Specification No. 70 Service Class C, and ANSI B30.2. The allowable design stress limits shall reflect the appropriate duty cycle in CMAA 70. Operational and rated load tests will be performed in accordance with ANSI B30.2. Tests will be performed in accordance with WVDP-082, WVNSCO Hoisting and Rigging Manual.

5.7.6 Operation of the RHWF cranes is not required during a seismic event, but the bridges and trolleys should be designed to remain in place while supporting up to full load on their respective runways with their wheels prevented from leaving the tracks during a seismic event. The Work Cell cranes shall be retrievable back to the Contact Maintenance Area after a seismic event.

5.7.7 The RHWF doors shall be sized to allow insertion and removal of the largest component. Permanent air locks shall be provided between contaminated and clean areas (mainly between Zone III and Zone II areas) for the insertion and removal of components such as shipping containers that have a high frequency of replacement or removal. Temporary air locks may be used for infrequent operations such as the insertion of the WTF Transfer and Decant Pumps. Removable roof hatches shall be provided in the Cell and Contact Maintenance Areas. |

5.7.8 The Work Cell cranes, power dexterous manipulators, in-cell cameras, and lights shall be integrated as necessary to ensure maximum efficiency and safety in operation. |

5.7.9 Routine transfer of small components into the Work Cell (clean, swipes, reels, bags, etc.) will be achieved through means other than the shield doors (e.g., transfer drawers and glove boxes. |

5.7.10 A transfer cell assembly, a shield box with double door opening in the bottom, a drop tube, and glove ports on the outside wall of the Work Cell will be installed to receive small items, mainly samples, from the Work Cell.

5.7.11 A work platform must be provided for routine inspection and maintenance of the cranes and the cables. |

5.8 Powered Roller Systems

5.8.1 The RHWF shall also provide all powered roller systems (PRSs) except as noted, to move waste containers from the Receiving Area to the Buffer Cell and from the Buffer Cell into the Work Cell. WVNSCO will provide the structural steel support frame and the load/guide rollers for the PRS in the Receiving Area. The RHWF shall provide the linear drive system for the PRS in the Receiving Area. The design shall include the embedment plates in the Receiving Area, Buffer Cell, and Work Cell for the PRSs. The PRSs will be used for everyday container handling operations. The PRSs shall be able to move containment pallets in lieu of using the Receiving Area crane or Work Cell cranes. Operation of the PRSs is not required during a seismic event. | |

5.8.2 The PRSs shall be positioned so as not to interfere with the operation of the shield doors. The direction of travel on each PRS shall be reversible. This will allow the backing up of a containment pallet or the more precise positioning of a containment pallet in the Receiving Area or in a cell. The Buffer Cell and Work Cell PRS system design shall provide a mechanism to secure the PRSs to the floor steel embedment plates. The Work Cell PRS will be remotely replaceable using the bridge cranes. The Receiving Area PRS system design shall include a structural steel support frame (provided by WVNSCO) to secure the PRS to the floor steel embedment plates. The Receiving Area and Buffer Cell PRSs will be locally replaceable using the bridge crane. The dimensions, securing mechanism, and the speed of operation of the PRSs shall be designed to provide maximum stability for the waste containers, drums and boxes that will travel on the PRSs. |

5.8.3 Maintenance of the Work Cell PRS shall be performed in the Contact Maintenance Area. The Work Cell PRS shall be able to be remotely decontaminated to allow hands-on maintenance. The Receiving Area and Buffer Cell PRSs will be maintained in place. The PRSs shall not be constructed with any hazardous or toxic materials. After their useful life the PRSs shall be disposed of as Industrial Waste or Low Level Radioactive Waste depending upon the contamination level.

5.8.4 The individual PRSs shall be controlled from and have an instrument station in the same area as their respective cranes (i.e. Work Cell cranes and Receiving Area crane). The Buffer Cell, Work Cell, and Receiving Area control and instrument stations shall be located at the shielded viewing windows. Each PRS control system shall be interlocked as required with other PRS control systems to ensure minimum risk of equipment loss and downtime and maximum efficiency and safety in operations. The following control features shall be provided:

A. Receiving Area and Buffer Cell PRSs shall have local disconnect and control for maintenance activities.

B. The Work Cell PRS shall have power, control, and instrumentation wiring connectors capable of being connected and disconnected by PDMs.

C. Each PRS linear drive shall have an encoder to provide the location of the drive point during operation.

D. Each PRS control and instrument station shall have panel lights to visually indicate the status of the controls and interlocked components during the operation.

5.8.5 The following safety standards are applicable to this section:

A. Safety Standard for Conveyors and Related Equipment (ANSI B20.1).

B. Safety Standard for Mechanical Power Transmission Apparatus (ANSI B15.1).

5.9 Power Dexterous Manipulators (PDMs)

5.9.1 The RHWF Work Cell shall be provided with power dexterous manipulators. The power dexterous manipulators will be used for performing miscellaneous functions. The manipulators should be able to handle standard tools, perform sampling tasks, have end effectors attached for decontamination purposes, etc. One of the Work Cell bridge cranes shall be equipped with two telescoping deployment tubes furnished with power dexterous manipulators. The jib crane will also be provided with a power dexterous manipulator.

5.9.2 As mentioned in 5.7.8, control of the power dexterous manipulators shall be integrated with the cranes, the cameras, and the lights as necessary.

5.9.3 The power dexterous manipulators, will be retrievable to the Contact Maintenance Area for maintenance and decontamination purposes. |

5.9.4 The following important parameters must be determined:

A. Degrees of Freedom and range of motion

B. Resolution, repeatability, and position accuracy.

C. Payload

D. Speed and drive system type

E. Control type

6.0 SAFETY DESIGN

6.1 General Environmental, Health, Safety, Radiation Protection

The RHWF and its systems shall be designed to the requirements stated herein and 10 CFR 835, 40 CFR 61 Subpart H, DOE Orders 420.1, 5400.1, 5400.5, 5480.22, 5480.23, 435.1, ANSI N13.1-1999 and WVDP requirements in WV-984 and WVDP-010. The requirements of 10 CFR 835 and DOE Orders 5400.5 and 5820.2A are described in WVDP-010 and WV-984 (see RC-ALARA-06 for document review and worker safety).

6.2 Safety Classification

The RHWF has been generally classified as safety Class C.

6.3 Radiation/Radioactive Contamination

6.3.1 General

The principle of "As Low As Reasonably Achievable" (ALARA) shall apply to all aspects of radiation exposure. The primary methods used for maintaining exposures ALARA shall be physical design features that ensure minimum exposure of workers to radiation and hazardous material. Administrative controls and procedural requirements shall be employed only as supplemental methods to control radiation exposure. DOE Order 420.1 will be the governing document for on-site facility safety and personnel exposure levels through the implementation of WVDP-010.

A. The facility shall include an early warning system for detecting the release and presence of radiological materials and radiation above the normal operational range.

B. The design of the Work Cell shielding shall be based on a 10 foot long line source geometry producing a radiation level of 5.7 rem/hr (equivalent to an initial source strength of 8.0 rem/hr after 15 years of decay) at a distance of 16.5" from the source. The

radionuclide on which the shielding design shall be based is Cs-137. The Work Cell design shall also assume contamination levels exceeding 10^{12} dpm/100 cm^2, and the presence of fine, loose contamination in the waste containers and work areas. Process operations such as handling, surveying, segmenting, decontaminating, and repackaging will be done remotely. Also, provision for temporary shielding will be considered to account for radiation levels higher than anticipated. This shall include methods to install, support and store temporary shielding. Consideration will be given to the use of modular shielding in lieu of or in addition to monolithic shield walls.

C. Design verification of shield wall thickness will be performed using independent calculation. The adequacy of shielding will be confirmed after startup using waste as the source.

D. The facility shall be designed to ensure control of airborne radioactive material. The system should avoid releases of radioactive materials into the workplace atmosphere and should control the inhalation of radioactive material by workers to levels that are ALARA and in accordance with 10 CFR 835. All discharges to the environment during normal operating conditions shall be below the allowable limits specified in 40 CFR 61 and 6 NYCRR 200-250.

E. The Work Cell and Buffer Cell shielding shall be adequate to protect RHWF personnel from excessive radiation in the Receiving Area, operating aisles, and Packaging Area during normal operations and during also during decontamination operations. Concrete shielding shall be designed in accordance with ANSI 6.4 to provide primary protection from radiation. Consideration should be given to modular shielding in lieu of, or in addition to, monolithic shield walls. In the event radiation levels are higher than anticipated consideration should be given to the provision of temporary shielding (i.e., steel). A system for supporting temporary shielding shall be incorporated into the facility design. The design bases used to define the thickness of the permanent shielding shall be as given in Item B above. Penetrations through shielding walls for windows, manipulators, instrumentation, piping, cables, ventilation ducts, etc., shall be designed to provide the shielding equivalent of the effective wall thickness and to minimize scattered radiation transmission. Spare wall penetrations shall be equipped with shield plugs.

F. Breathing air supply will be needed in the Buffer Cell and the Contact Maintenance Area where manned entry is allowed for contact operations (contamination level 10^4-10^6 dpm/100cm^2). Necessary permanent equipment shall be installed to ensure that breathing air meets the

United States Pharmacopoeia and ANSI/Compressed Gas Association Commodity specification for Air, G-7.1-1989, requirements. Therefore, drying, and filtering, with associated control capabilities shall be provided to guarantee that breathing air quality can be attained. Also, the following safety measures have to be implemented:

1. Breathing air couplings will be incompatible with outlets for non-respirable worksite air or other gas systems.

2. No asphyxiating substance shall be introduced into breathing airlines.

3. Provide all necessary safeguards if utility air is used as breathing air.

G. There will be remote air sampling of contaminated areas requiring manned entries.

6.3.2 Radiation Dose Rates for Various Areas

The facility shall be designed to the following:

A. The maximum radiation dose rate for a full-time occupancy area shall be 0.1 mRem/hour. A full-time occupancy area is one in which an individual(s) may be expected to spend all or most of his or her work day. Annual exposure shall not exceed the Project-established limit of 500 mRem per individual.

B. The maximum radiation dose rate for a full-time access area shall be 1.0 mRem/t, in which "t" is the maximum average time in hours per day that the area is expected to be occupied by any one individual. A full-time access area is one in which no physical or administrative control of entry exists.

If compliance with full-time access area requirements would not be economically feasible, impractical, or prohibitive, higher dose rates may be allowed. However, access to such fields shall be strictly controlled. In these normally unoccupied areas, the maximum radiation dose rate shall be 4 mRem/hr, except when waste packages are present.

6.3.3 Area Occupancy

The RHWF Work Cell shall be designed for remote operation with no planned manned entry of the cell during radioactive operations. The RHWF control areas where control stations are located, shall be defined as a full-time occupancy area. All other areas of the RHWF shall be defined as full-time access areas. Environmental monitoring equipment shall be located in a full-time (uncontrolled) access area.

6.3.4 Areas for personnel monitoring shall be provided in the facility. Personal decontamination, if required, will be performed in another facility.

6.4 Contamination Confinement

6.4.1 General Requirements

The design shall control the cross spread of contamination typically caused by: (i) overlap of traffic for the clean and contaminated containers, (ii) simultaneous (concurrent) handling, operations, and interim storage of contaminated, as well as, clean waste containers, work tools, instruments, and service utilities. Typical measures to achieve isolation of the clean from the contaminated areas is by conducting operations in separate cells, the use of local HVAC (glove box/hood-type operations) for high-contamination areas, and eliminating cross traffic.

Confinement of radioactive contamination shall be accomplished using four primary design principles:

A. Using sufficiently air-tight physical boundaries to keep contamination as close to the source as practical.

B. Using multiple barriers. Each zone shall be bounded by barriers, such as pipes, and vessels, different pressure zones, and building walls.

C. Double air locks will be provided as a buffer zone between Zone III and Zone I areas such as the Contact Maintenance Area where manned entry is permissible. Space for the erection of containment tents at the entrance to single air locks shall be allocated. Also, space for personnel to change in to and out of protective clothing will be allocated.

D. Breathing air supply systems shall comply with 29 CFR 1910.134. Particular attention should be paid to the location of hookups to the breathing air supply to minimize having to manage long lengths of breathing air hose.

E. Maintain pressure differentials between each confinement zone and between the outermost zone and the outside atmosphere. Air flow travels from zones of lesser contamination potential to zones of greater contamination potential under normal and off-normal conditions. HVAC zones with differential pressures shall be provided. The definition of these zones is as follows:

Zone I designates areas that are expected to contain radioactive materials during normal operations.

Zone II designates the operating area and other potentially contaminated areas surrounding Zone I. These spaces are normally not contaminated.

Zone III designates areas inside buildings that are expected to be free of contamination at all times.

F. Dust and fine particulate-capture units shall be provided inside the Work Cell. The number of these units should be determined at the preliminary design stages. The function of these units is to collect airborne material that is generated during process operations (cutting and sawing) inside the Work Cell. These units should have the capability of being operated and serviced remotely, particularly the filters and the motors. The capture units should be specified to reduce the frequency of changing the in-cell HEPA filters and to extend the service of these units.

6.4.2 Ventilation Requirements

A ventilation and filtration system shall be provided to maintain the release of radioactivity and airborne particulates to the environment within limits of DOE Order 420.1, Section 4.1.1.2, "Requirements for Radiation Protection," and any applicable state and federal requirements (see Section 6.3.D). System design parameters shall be in accordance with the ERDA 76-21, Nuclear Air Cleaning Handbook.

A. Damper and/or HEPA filters (to be decided upon during the design stages) shall be provided to ensure that inadvertent back flows are filtered or prevented. Means (such as nuclear grade butterfly valves) should be provided to positively seal all Zone I penetrations. HEPA filters intended to act as back flow preventers between Zone I and Zone II spaces must be selected based on the available pressure differential.

B. Outdoor air intakes will be located so that they are protected from the weather. The intake design shall consider the effects of high winds, rain, snow, airborne debris, motor exhaust emission, and proximity to natural gas piping so as to prevent blockage or restriction. Supply air will be conditioned and prefiltration shall be considered and implemented, if required. The HVAC supply and exhaust systems shall be based on 100% makeup air, except for the office area.

C. Air streams from all Zone I spaces shall be filtered by a minimum of two banks of fire-resistant HEPA filters in series prior to exiting to the atmosphere. HEPA filters shall meet the requirements of ASME AG-1. Air streams from all Zone II spaces shall be filtered by a minimum of one fire-resistant HEPA filter prior to exiting to the atmosphere. Locate filters as close as possible to the source of contamination to minimize contamination of downstream ducting.

1. HEPA-type filters installed in the Work Cell shall be designed to collect dust and debris during waste handling operations. For maintenance purposes, each filter bank shall be capable of being isolated for filter element change out. The filters shall be protected from damage from routine in-cell operations. The in-cell prefilter system shall only be PAO-tested during startup. PAO testing during operation will not be required.

D. Dampers or valves will be located so that a bank of filters can be completely isolated from the operating ventilation systems during filter replacement operations. HEPA filter isolation dampers/valves shall be leak-tight construction Class A dampers, with Class I leakage. Each exhaust filter housing will have a rigid mounting frame for the filter. Openings in these housings should permit filter removal and replacement with minimum exposure to personnel and with minimum release of contaminants outside the housing (bag in-bag out). Sufficient clear space shall be allocated at all HEPA filter housings for changing out HEPA filters.

E. Test ports for in-place filter testing using ANSI Standards 509 (Design) and 510 (Testing) will be provided for PAO-testing the HEPA filter housings required to protect the environment from radioactive releases. HEPA filter systems will be tested in accordance with ANSI 510 requirements. Utility air service in the vicinity of all HEPA filters that are to be PAO-tested will be provided.

F. Filtered air will be discharged to the environs through a stack. The design shall incorporate a stack monitoring system that meets the requirements specified in Section 6.5.2. The stack monitoring system shall alarm in the RHWF control station area, Main Plant Shift Office, and/or Security Gatehouse System.

G. Comfortable working conditions shall be maintained in all manned support areas, excluding the truck loading/unloading areas; summer 70EF ±2EF; winter 70EF ±2EF. Louvered vents for directing air flow towards operators at workstations will be provided. Humidification/dehumidification controls are not required.

H. The duct work shall be designed to withstand the full shut-off pressure of the fans. The HV systems in contaminated areas shall be constructed of welded stainless steel; including duct work, in-line components, and filter housings. Duct connections to component (fan(s), filter housing(s), etc.) shall be flanged and gasketed to permit installation, maintenance, and access. Weld protrusion shall be

minimized, and ledges and radioactive contaminate traps shall be minimized. Route contaminated ducts so as to minimize their overall length. The remaining duct work in noncontaminated or nonradioactive areas may be constructed of galvanized steel, except when hoods or glove boxes exhausts are utilized, (stainless steel shall be provided).

I. Devices shall be provided to control and/or indicate pressure differentials between confinement zones and across HEPA filters. Alarms shall be provided in the control station area to indicate when pressure differentials are not within a prescribed range.

J. The facility HV system shall have redundant equipment/components as follows:

1. 100% redundancy for main exhaust fans and associated controls.

2. A minimum of 50% redundancy for HEPA filters serving Zone I and Zone II spaces.

3. Alternative / automatic means for providing makeup air or reducing the need for make-up air for Zone I exhaust, when the normal HVAC supply unit is off.

K. All discharges to the environment during normal operating conditions shall be below the allowable limits specified in 40 CFR 61, Subpart H.

L. Ventilation fans should use off-the-shelf, industry standard, and recognized components as much as possible (avoiding custom components, configurations, and arrangements). Also, ensure there is sufficient space for and access to and around the equipment used.

M. See Section 6.4.5 for fire protection.

N. Separate ventilation exhaust fan(s) shall be provided for the truck load out area to mitigate vehicle exhaust from combustion engines.

O. UPS battery enclosures shall be vented to the atmosphere.

6.4.3 Design Basis

A. All structures that form the Zone I confinement boundary shall be designed to continue to perform their contamination confinement function during and after the occurrence of a design basis event, accident, or credible fire or explosion.

B. Ductwork connected to a Zone I space and which has the potential for being breached during a design basis accident shall be fitted with a fire-rated damper to prohibit the extraction of contamination.

C. Areas designated as Zone I, II, and III spaces shall be constructed in such a manner that their respective vacuum/pressure operating requirements can be maintained. Negative pressure in the Work Cell shall be used to control the facility HV system. Other controls and dampers shall be integrated into the design of the facility HV system so that the entire system functions properly.

D. Total airflow through and exhausted from the facility should be minimized to the extent practical. The facility is to be designed to minimize infiltration of outdoor air and the infiltration of air between adjacent spaces/zones. The HVAC supply and exhaust systems shall be based on 100% makeup air, except for the office area.

1. Provide the capability to increase total airflow through the HVAC exhaust system by 133% above that required by ERDA 76-21 standards by: increasing the fan speed of the main exhaust fans, replacing 1000 cfm rated HEPA filters with 1500 cfm rated HEPA filters, and sizing ducting and filter housings that transfer air between cells/zones accordingly. This operating margin shall be preserved during design to accommodate excess infiltration of outdoor air above design values.

E. Cooling equipment (e.g., chillers) must be capable of operating at the minimum cooling load in the winter without short cycling and still be capable of satisfying the maximum load in the summer.

F. Material handling equipment should be provided to service all HEPA filter banks more than 48" above the floor.

G. Field-adjustable, high-quality dampers should be provided at all supply air, transfer air, and exhaust air terminals for startup and commissioning, and for balancing during operations.

H. Insulation/drain pans at all ductwork, cooling coils, and where the surface temperature may be colder than the dew point of the surrounding air, which results in condensation formation, should be provided.

I. Freeze protection for all liquid-filled piping should be provided in areas where the potential for freeze-up exists (e.g., truck doors, entry doors, and fresh air inlets).

J. The design shall take into consideration the potential for the presence of airborne hazardous constituents such as lead, mercury, or chromium. The system is to be designed to minimize the potential for generation of mixed waste.

6.4.4 Criticality

The nuclear criticality safety program for the WVDP includes new hardware required to be functional for criticality safety. Storage racks, pipes and vessels containing fissionable material, and overhead piping in moderator-controlled areas shall be designated to withstand design basis phenomena, such as earthquakes, in accordance with DOE Order 420.1, such that a design basis event will not cause or allow a criticality accident to occur.

A. Storage racks shall be designed, fabricated, and maintained in accordance with good engineering practices (ANSI/ANS-8.7-1975,R87, Section 4.2.2).

B. Storage of fissionable materials shall obviate concern with accidental nuclear criticality in the event of fire, flooding, earthquake, or other natural calamities (ANSI/ANS-8.7-1975,R87, Section 4.2.3.).

C. The design of storage racks should tend to preclude unacceptable arrangements or configurations, thereby reducing reliance on administrative controls (ANSI/ANS-8.7-1975,R87, Section 4.2.4).

D. The spacing of material may be maintained by the use of birdcage fixtures, covered metal cans, or physical barriers on shelves. Shelving shall be sturdy and noncombustible (ANSI/ANS-8.7-1975,R87, Section 4.2.5).

E. Dimensions of as-built equipment (e.g., storage racks, volumes, slab thickness, or cylinder diameter) that are important to criticality safety shall be verified prior to operation and be documented.

F. If required by analysis, nuclear accident dosimeters shall be provided, as required by DOE Order 420.1. Their performance features and placement shall be consistent with the requirements of DOE Order 420.1, Section 4.3.

G. The design of sumps, floor drains, and drain collection tanks shall obviate concern with accidental nuclear criticality as a result of the collection and accumulation of fissionable materials.

6.4.5 Fire Protection and Life Safety

Protection against fire and the preservation of life through comprehensive fire protection design features shall be utilized to serve the RHWF. Specific guidelines are provide in

DOE Order 420.1 - Facility Safety, NFPA 801 - Standard for Facilities Handling Radioactive Materials, and other related NFPA Standards. Site-specific guidelines can be found in WVDP-177 - Fire Protection Program, Chapter 5.

Preservation of life against fire or the effects of fire shall be governed by NFPA 101, Life Safety Code. Classification of the facility and its hazards shall be appropriately determined.

Fire protection for the RHWF shall be based upon a comprehensive Fire Hazard Analysis,(FHA), WVNS-FHA-014 of the facility and its process. Development of the FHA shall be in parallel with the Safety Analysis Report. A preliminary (pre-construction) FHA shall be developed to ensure all design criteria has been addressed as the design criteria relates to the facility's occupancy, hazards, and process.

When required, fire protection shall include:

A. Features such as fire walls, doors, fire-rated dampers, and windows incorporated into the design to reduce the size of the fire areas, stop the spread of fire, minimize dollar loss, and ensure the preservation of life.

B. Specialized fire protection materials to seal conduit penetrations, cable tray penetrations, and floor penetrations as applicable to the fire area. All materials and sealing methods shall be standardized throughout the facility and be Underwriters Laboratory (UL) approved for its application.

C. Fire suppression systems shall be installed to meet the protection requirements as dictated by the hazard. The design shall include a water sprinkler fire suppression system except in the Buffer Cell, Work Cell, and Contact Maintenance Area.

D. A Fire Alarm and Detection System shall be installed to provide early detection of a fire condition and provide audible and visual indicators to alert occupants for evacuation.

   The Fire Alarm and Detection System shall be a fully addressable system which that provide point-to-point addressable notification of all devices including smoke detectors, heat detectors, manual pull stations, and interface devices. Interface devices shall be used in conjunction with sprinkler flow switches, pressure switches, valve tampers, and other related systems.

   The system shall be designed as follows:

   1. The Signaling Line Circuit shall be Class A, Style 5a, in accordance with NFPA 72, Table 3-6.

2. The Notification Appliance Circuit shall be Class A, Style Z, in accordance with NFPA 72, Table 3-7.1.

3. All wiring shall be in accordance with the National Electric Code, Article 760.

The system shall also be capable of incorporating programmable output relays for the control of ancillary functions such as HVAC dampers, HEPA filters, blower controls, smoke doors, and Keltron™ alarm activations.

The system make and model shall be that as used in the Vitrification facility and 01/14 Building (i.e., Siemens MXL Advance Protection System).

A Keltron alarm Data Gathering Panel (DGP) shall be incorporated into the design to transmit fire alarm and sprinkler alarm signals to the Main Gate Guard House. The transmission signal from the DGP to the Guard House shall be two dedicated telephone pairs with two additional pairs provided as backups. A remote annunciator panel shall also be located in the RHWF.

E. RHWF control stations shall be protected as necessary. HVAC system controls shall be protected with redundant suppression systems as required. Redundant protection of remote control functions is not required. Also, the HEPA filters will be provided with fire/smoke detection and external suppression protection.

F. All fire protection systems shall be considered as part of the site fire protection resources. System #33 shall be assigned to the sprinkler and underground fire mains. System #33A shall be assigned to the fire alarm and special hazard systems. Operational responsibility for these systems and final readiness approval rests with the Main Plant Operations Manager (WVNSCO Fire Protection Program Manager). |

6.4.6 Industrial/Occupational Safety

Design requirements in the industrial/occupational safety area are numerous; the designer must reference the source documents that define the requirements. These safety documents include DOE Order O 440.1A, "Occupational Medical," Attachment 2, Section 19; "Construction Safety," Attachment 2, Section 14; "Industrial Hygiene," Attachment 2, Section 18, and OSHA Document 29 CFR 1910; "General Industrial Standards."

A. Typical areas for occupational safety review

The following list identifies typical design areas and facility features that could have potential occupational safety, industrial hygiene, or medical requirements:

1. Electrical equipment, especially locking and tagging equipment and ground fault protection.

2. Aisles, walkways, exits, clearance, floors, stairs, platforms, railing, and work surfaces.

3. Material-handling equipment, traffic control, cranes, and rigging, ability to install scaffolds where they may be required.

4. The roof design must account for fall protection.

5. Machinery guarding, maintenance, and lubricants.

6. Pressurized equipment, tanks, and relief valves.

7. Dust, fumes, vapors, and gases.

8. Personnel protective equipment.

9. Office and equipment operation ergonomics.

10. Traffic control barriers and barricades.

11. Areas must provide for emergency responder accessibility. Evacuation routes must be defined and identified by positions.

12. Thermally hot surfaces, such as steam lines.

13. Potential pinch points, especially when handling waste containers.

14. Weights to be manually lifted (back safety).

15. Spill control.

16. Potential exposure to high-intensity visible light from welding arc, cutting torches, or lasers.

17. Provide heat tapes on roofs to prevent dangerous buildups of snow and ice over pedestrian walkways.

B. Noise

Noise levels shall be limited to 70 decibels or less in areas of continuous occupancy, and shall not exceed 85 decibels in other personnel access areas. Warning signs and hearing protection devices shall be provided as necessary.

C. Chemicals

1. Process reagents and decontamination solutions such as acids, caustics, metal salt solutions, oxidizing solutions, and cryogenic gases may be prepared and used in the facility.

2. Adequate chemical receipt, storage, and makeup areas shall be provided.

3. Face shields, protective clothing, safety showers, and eye wash fountains shall be provided near the chemical makeup areas and throughout the facility as needed.

4. An exhaust system shall be provided to remove chemical fumes and dust if required.

5. Particular attention should be paid to the design of systems for handling gases that are toxic, asphyxiating, irritating, or noxious, including appropriate monitoring or warning systems.

6. All chemical storage tanks will have the ability to be sampled using remote sampling equipment and techniques.

7. The mixing of incompatible chemicals shall not be allowed.

6.4.7 Emergency Planning

A. The facility design shall include emergency equipment, and shall ensure that facility features provide for ease of accessibility for emergency responder personnel and have identified evacuation routes posted. Emergency requirements and procedures will be coordinated with the overall "WVDP Emergency Plan," WVDP-022.[12] and WVDP-139, Volume I, "Emergency Management Implementing Procedures (EMIPs)"

B. Power-fail telephones and a public address (PA) system shall be provided as a functional part of the overall emergency warning system and shall be incorporated into the overall WVDP 812 "All Page" System.

6.4.8 System or Control Malfunctions

A. The RHWF shall be designed to the Defense-in-Depth concept that provides for multiple layers of safety provisions incorporated into facility design, operations, monitoring and controls, and accident mitigation.

B. A single failure or malfunction of any system or equipment item shall not initiate a failure sequence that results in criticality, uncontrolled release of radiation to the environment, or radiation exposure to operating personnel or the general public in excess of the limits set forth in DOE Order 5480.1, Chapter XI, "Requirements for Radiation Protection."

6.4.9 Loss of Normal Electrical Power

Back-up power is required for systems which if failed would impact the health and welfare of the public and/or reasonable operational stability, such as the HVAC system and the stack monitoring system.

6.5 Environmental Features

All waste generated and processed shall be assayed in accordance with site Waste Management procedures. In addition, the RHWF design will also comply with all applicable USEPA, NYSDEC rules, DOE Regulations, Orders, Directives, and Agreements.

Where possible, radioactive liquid waste, hazardous materials, and secondary waste will be recycled within the RHWF (e.g., filter out solids and reuse slightly contaminated decon solutions).

6.5.1 Solid Waste

RHWF expended equipment, and components that are used to process the waste streams, will be handled in a fashion similar to other wastes. They shall be sorted, segregated or size-reduced, decontaminated, and packaged in a shippable-ready form in compliance with all applicable environmental regulations and requirements.

HEPA filters will be replaced as required. The used filters will be processed and packaged in a disposal-ready form.

6.5.2 Air Effluents

Ventilation air will be processed through HEPA filters and will be discharged through the RHWF building stack. These releases shall be subject to applicable Environmental Protection Agency (EPA), New York State Department of Environmental Conservation (NYSDEC), and Department of Energy (DOE) regulations, Orders, Directives, and agreements. These regulations shall include, but not be limited to, 40 CFR 61 Subpart H, 6 NYCRR Part 201, and DOE Order 420.1. In particular, the design of the RHWF air cleaning and stack monitoring/sampling systems shall conform with the requirements in ANSI N13.1-1999. Table 2 of ANSI N13.1 presents a graded approach for determining sampling and monitoring requirements based on the facility’s potential to emit. All permits for the construction and operation of the facility shall be procured in compliance with the above-cited regulations and requirements.

The RHWF Stack design shall provide a sampling location that meets the qualification criteria of ANSI N13.1- 1999. Table 6 of ANSI N13.1 presents a summary of performance criteria that must be accounted for in the design.

In accordance with ANSI N13.1-1999, the monitoring/sampling system design shall provide for, but is not limited to the following aspects: A minimum of 50% penetration of 10 micron

particles; The ability to perform inspections; A system that will allow leak checks; A rationale for the sampling system design; Flow controllers that meet performance criteria; A means to calibrate flow sensors. Table 5 of ANSI N13.1 provides a summary of the maintenance requirements to be considered in the design.

Significant effort is needed to qualify the sampling location and to document compliance with ANSI N13.1-1999. To mitigate the risk of future modifications, WVNSCO will require an independent verification conducted by a qualified individual or agency who is experienced in single point sampling employing shrouded probe technology. WVNSCO will provide the independent review. The independent review will focus on design parameters in order to provide recommendations for the performance of scale model testing. Recommendations of the reviewer shall be incorporated in the design and/or scale model test.

The design/build contractor shall provide a schedule and a scale model test plan for approval prior to submission of this plan to the testing agency. An estimated 12 month period is required after the completion of testing and final test report for regulatory review prior to construction. This should be considered in the schedule being submitted for approval.

Construction of the stack can not be started until the final test report is approved by WVNSCO. This will ensure that documentation is in place to qualify the sampling location and sampling system and verify compliance with ANSI N13.1-1999.

6.5.3 Liquid Waste

A drain collection tank will be provided for temporary storage/sampling of liquid waste, such as floor drains. The design requirements of DOE Order 435.1 shall apply (see section 5.4.2 of this document). The capacity of this tank will be based on the nominal amount of water that is expected to be collected during one 8-hour shift of equipment or facility decontamination. The collection tank contents will then be transferred to existing on-site treatment facilities for processing. The use of chemicals which cannot be processed by existing WVDP treatment facilities shall not be allowed.

A means to prevent accidental release of reportable quantities of contaminated fire fighting water to the environment, such as curbs and dikes, shall be included.

An ion exchange system, supplied by WVNSCO, shall be installed in the RHWF for preliminary processing of secondary liquid waste prior to wastewater transfer to the LWTS. The ion exchange system is primarily for the removal of Cesium 137 from the wastewater. This system will be comprised of three major subsystems, the prefilters and ion exchange columns, the pumps and control valves, and the control station. The prefilters and ion exchange columns shall be installed inside the Work

Cell in a location and orientation that permits remote change out of the filters and ion exchange media. The pumps and control valves shall be installed in the Contact Maintenance Area and the control station installed in the Operating Aisle. This system shall be connected to the drain collection tanks and the batch transfer tank.

6.5.4 Waste Minimization and Pollution Prevention

Activities that involve waste generation (radioactive, hazardous, mixed, and industrial waste) necessitate design practices that emphasize waste minimization and pollution prevention. These practices will generate cost avoidance in the areas of waste treatment, storage, and disposal, and provide lower health risks for the workers and the public. The following practices should be considered during the design:

A. Source reduction (reducing waste generated at the source) and recycling of waste as much as practical. (e.g., re-use of emptied waste containers, if it is viable).

B. Reduce/eliminate the use of energy, water, or other resources through changing processes, recycling, or using products that contain recycled materials.

C. Protect natural resources through either conservation or more efficient use of materials. For example, hazardous solvents can be replaced with nonhazardous solvents, or waste water discharges can be reduced/eliminated. Also, paper, scrap metal, and other materials can be recycled.

D. Reduce/eliminate the use of hazardous materials through material substitution, changing processes, or recycling. The introduction of hazardous materials into the Work Cell is strictly prohibited.

6.5.5 Ground Water Monitoring

Groundwater monitoring shall be consistent with the requirements of DOE Order 5400.1, "General Environmental Protection Program." Sufficient monitoring capabilities may be provided by existing groundwater monitoring wells. Therefore, no additional groundwater monitoring needs to be included in the RHWF design. Any additional groundwater monitoring required in the future will be provided by WVNSCO.

7.0 INTERFACES

The RHWF must be designed to interface with other systems as described in this section. Further details shall be provided as required during the final design phase.

7.1 Siting Criteria

The RHWF will be located within the site premises, on the North Hard Stand. This location should provide adequate protection for the health and safety of the workers and the public, including those at adjacent facilities, from the effects of potential accidents involving the release of hazardous or radioactive materials from the RHWF. Similarly, workers in the RHWF will be protected from hazards due to nearby installations or activities. The following are criteria for selecting the facility location:

- Maintaining a safe distance and ensuring protection from existing radiation fields and existing radiological or chemical contamination.
- Providing interfaces with existing facilities, as needed, while minimizing the distance for conveying radioactive materials.
- Where possible, process and utility piping systems shall be located to allow building and process expansion.
- Minimizing interferences with existing and proposed structures, both above and below ground, including roadways.
- Providing ready access for receiving and removing materials and equipment.
- Providing good vehicular and pedestrian traffic patterns.
- Providing adequate protection from the effects of natural phenomena to the extent possible.
- Facilitating separate temporary access during construction.
- Minimizing the disturbance of contaminated soil.
- Consideration of proximity to the site boundary and land use characteristics of the site surroundings.
- The potential for "radiation shine" at Rock Springs Road from the RHWF.
- Subsurface geological conditions for the proposed location of the RHWF are under study. Specifically, the top of the Lavery till geologic unit should be of sufficient depth to allow only minimal disturbance, if any, during excavation and installation of potential support structures (e.g., piles).
- Sites where geologic surface processes such as erosion, slumping, or land sliding may significantly impact the RHWF, were avoided.
- The ongoing stream erosion and gully growth are not anticipated to be a concern over the useful life of the facility.

7.2 Interfacing Systems and Structures

7.2.1 Transportation Packaging and Storage

A. The RHWF will receive containers filled with waste from the CPC-WSA, Waste Tank Farm, Lag Storage Areas, Vit Facility (EDR) and Main Plant. The facility shall have the capability of receiving these waste streams and delivering processed waste containers to an interim storage and/or shipping facility.

B. The RHWF must interface with the transportation systems that are available on site. The waste containers will be loaded onto an appropriate type of vehicle and transported to the RHWF in accordance with Transportation Compliance Manual, WVDP-112.

C. Adequate access roads and driveways to and from the RHWF will be provided. The RHWF access road from the CPC-WSA will be designed for heavy haul loads to be delivered to the Receiving Area roll-up doors (north and west sides). There will be a limited number of heavy loads (approximately 35) from the CPC-WSA that will be transported by a customized shielded fork lift that will have a drive axle load of approximately 93,500 lb. With a tire footprint of 780 sq. in., this translates to a ground pressure of approximately 120 psi.

D. The Lag storage system will be used for temporary storage of analyzed waste containers. It is possible that after processing the contents of the CPC-WSA that the CPC-WSA structure may be used for temporary storage of low-level waste.

7.2.2 Modular-type facilities attached to the Work Cell

(e.g., laboratory facilities, vendor-supplied equipment, decontamination systems, or additional Work Cell space). The RHWF shall be designed to accommodate future, structural tie in of the modules as well as provide excess utility capacity.

7.2.3 The LWTS evaporator and CSS are assumed to be available for

| processing secondary liquid waste generated in the RHWF. A
| preliminary liquid waste processing system, supplied by WVNSCO,
| shall be installed in the RHWF for removal of Cs-137 prior to the transfer of liquids to the LWTS. If the LWTS evaporator is no longer available, then a vendor-supplied liquid waste treatment is assumed to be available.

7.2.4 Tank 5D-15B in the LWTS is assumed to be available for the collection of secondary liquid waste.

7.2.5 Tie-ins to sanitary systems (e.g., provisions for restroom facilities in office area).

7.2.6 Tie-ins to communication systems (e.g., 812 "All Page," telephone, plant paging system, personal computers and intercoms).

7.2.7 Tie-ins to alarm systems (e.g., rad monitoring system in rad protection Shift Supervisor's Office, Keltron fire alarm system in Main Gatehouse, security system).

7.2.8 Provide spare wall penetrations through which hoses or cables can be routed, for the purpose of suppling high pressure water, decon solutions, grout, cameras, breathing air hoses, electrical power for tools, etc. into the cells.

7.3 Service Utilities

The following service utilities are currently available from the existing plant and may be used for the RHWF.

UTILITY SERVICE	PRESSURE/VOLTAGE	MAXIMUM AVAILABLE
Natural Gas	4-5 PSI	3500 CFH
Potable Water	40-60 PSI	25 GPM
Demin. Water	55 PSI	30 GPM
Fire Water	135 PSI static 86 PSI residual	1443 GPM
Instrument Air	45-55 PSI	60 SCFM
Electrical	480 volt 3 phase	388 KVA
Standby Electrical	480 volt 3 phase	200 KVA

8.0 QUALITY ASSURANCE

The Quality Assurance (QA) Program requirements for the Remote-Handled Waste Facility are defined in WVDP-111, WVNSCO Quality Assurance Program. This QA Program is based on and satisfies the QA Rule and the QA Order. The WVNSCO policies relative to the implementation of this Quality Assurance Program are delineated in WVDP-002, Quality Management Manual, which is based on meeting the requirements of ASME NQA-1. Departmental procedures (such as the Engineering Procedures Manual, Procurement Manual, Records Management Manual, etc.) provide the detailed requirements for the implementation of the Quality Assurance Program.

WVDP-204, "Quality List" (Q-List), has been revised to list the classification and quality levels for the RHWF and its major subsystems.

The safety class, as identified in Section 6.2, drives the quality level, which in turn establishes the programmatic implementation of the Quality Assurance Program which is based on the 18 criteria of ASME NQA-1 and all applicable supplements.

9.0 DECOMMISSIONING

The RHWF and structures shall be designed in accordance with ANSI-N-300, "Design Criteria for Decommissioning of Nuclear Fuel Reprocessing Plants."

10.0 APPLICABLE CODES AND STANDARDS

These codes and standards are required, but are not all inclusive. The following codes and standards are applicable to the design of the RHWF. Unless specified herein, the code or standard effective date is the latest edition date at the time of contract or order placement.

10.1 Commercial Codes and Standards

ACI 318, Building Code Requirements for Reinforced Concrete

ACI 349, Code Requirements for Nuclear Safety Related Concrete Structures

AISC Manual, American Institute of Steel Construction, Manual of Steel Construction

ANSI 509, Nuclear Power Plant Air Cleaning Units and Components

ANSI 510, Testing of Nuclear Air Treatment Systems

ANSI B15.1, Safety Standard for Mechanical Power Transmission Apparatus (Published, October 08, 1996)

ANSI B16.5, Steel Pipe Flanges and Flanged Fittings

ANSI B20.1, Safety Standard for Conveyors and Related Equipment (Published, May 23, 1997)

ANSI B30.2, Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley)

ANSI N13.1, Sampling and Monitoring Releases of Airborne Substances from the Stacks and Ducts of Nuclear Facilities (1999)

ANSI N14.5-85, Leakage Tests on Packages for Shipment of Radioactive Materials.

ANSI Y14.5, Drawings

ANSI Z223.1,

ANSI 6.4 (1997)

ANSI/ANS-8.7-1975, R87,

ANS, Series 8, Criticality Safety Standards

ASCE 7, American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures

ASHRAE 62,	Ventilation for Indoor Air Quality
ASME,	ASME Boiler and Pressure Vessel Code, Pressure Section VIII Vessels
ASME AG-1,	Code of Nuclear Air and Gas Treatment
ASME B31.3,	Chemical Plant and Petroleum Refinery Piping
ASME B31.9,	Building Services Piping
ASME-NQA-1,	Quality Assurance Program Requirements for Nuclear Facilities
ASTM,	American Society of Testing and Materials
AWS D1.1,	American Welding Society, Structural Welding Code
CMAA 70,	Crane Manufacturers Association of America Specification No. 70, Specifications for Electric Overhead Traveling Cranes
ISA-S5-2,	Instrument Society of America (Symbology)
NEC,	National Electrical Code (1999)
NEMA 1B-1	
NEMA ICS	
NEMA RI-2	
NEMA ST-20	
NEMA MG-1	
NFPA,	National Fire Protection Association, National Fire Codes, Standards, Recommended Practices, and Manuals
NFPA 13,	Sprinkler Systems (1996)
NFPA 24,	Standard for the installation of Private Fire Service Mains (1995)
NFPA 54,	National Fuel Gas Code (1999)
NFPA 70,	National Electric Code (NEC) (1999)
NFPA 72,	National Fire Alarm Code (1999)
NFPA 80,	Standard for Fire Doors and Windows (1999)
NFPA 90A,	Standard for the Installation of Air-Conditioning and Ventilation Systems (1999)

NFPA 90B, Standard for the Installation of Warm Air Heating and Air Conditioning Systems (1999)

NFPA 101, Life Safety Code (1997)

NFPA 780, Standard for the Installation of Lightening Protection Systems (1998)

NFPA 801, Standard for Fire Protection for Facilities Handling Radioactive Materials (1998)

NSPC, National Standard Plumbing Code

UBC, Uniform Building Code, International Conference of Building Officials

UL 586, High Efficiency Particulate Air Filter Units

UL 984 Hermetic Refrigerant Motor-Compressors

10.2 U.S. Department of Energy Documents

DOE/EH-0173T, Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance

DOE O 151.1A, Comprehensive Emergency Management System

DOE O 414.1A, Quality Assurance

DOE O 420.1A, Facility Safety

DOE O 435.1, Radioactive Waste Management

DOE O 440.1A, Chapters 1 and 2, Worker Protection Management for DOE and Contractor Employees

DOE P 450.4, Safety Management System Policy

DOE O 460.1A, Packaging and Transportation Safety

DOE Order 5400.1, General Environmental Protection Program

DOE Order 5480.1, Chapter XI, Requirements for Radiation Protection

DOE Order 5480.4, Environmental Protection, Safety, and Health Protection Standards

DOE Order 5480.11, Radiation Protection for Occupational Workers

DOE Order 5480.22, Technical Safety Requirements

DOE Order 5480.23, Nuclear Safety Analysis

Other DOE Commitments

Executive Order 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements

Agreements

Federal Facility Compliance Agreement with WVNSCO for Mixed Waste |

DOE Standards

DOE-STD-1066-99, Fire Protection Design Criteria

WIPP-DOE-069, TRU Waste Acceptance Criteria for the Waste Isolation Pilot Plant

ERDA 76-21, Nuclear Air Cleaning Handbook

10.3 State Documents

Title 6 NYCRR - Official Compilation of Codes and Regulations of the State of New York

NYS Manual for the State Building Construction Code

NYS Energy Conservation Code

10.4 Federal Regulations

U.S. Nuclear Regulatory Commission

10 CFR 20, Standards for Protection Against Radiation

10 CFR 61, Licensing Requirements for Land Disposal of Radioactive Waste

10 CFR 71, Packaging and Transportation of Radioactive Materials

U.S. Department of Energy

10 CFR 830.122, Quality Assurance Requirements

10 CFR 835, Occupational Radiation Protection

U.S. Environmental Protection Agency

40 CFR 61, National Emissions Standards for Hazardous Air Pollutants (Subpart H, Radionuclides)

40 CFR 265, Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.

U.S. Department of Transportation

49 CFR 173, General Requirements for Shipments and Packaging

OSHA

29 CFR 1910, Occupational and Health Standards

29 CFR 1926, Safety and Health Regulations for Construction

10.5 Federal Design Standards

NUREG 0800 - Standard Review Plan, Section 3.3.1, "Wind Loadings"

NUREG 1199 - Standard Format and Contents of a License Application for a LLRWDF

NUREG 1200 - Standard Review Plan for the Review of a License Application for LLRWDF, SAR, 1188

IAEA

Safety Standards - No. 6, Regulations for the Safe Transport of Radioactive Material

Safety Guides - No. 7, Explanatory Material for the IAEA Regulations for the Safe Transport of Radioactive Material

No. 37, Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material

10.6 WVNSCO Design Guides

SOP 00-30, System and Component Labeling

WV-100, Integrated Safety Management and Control of Documents

WV-984, ALARA Program

WVDP-010, WVDP Radiological Control Manual

WVDP-011, Hygiene and Safety

WVDP-022, WVDP Emergency Plan

WVDP-062, Drafting Manual

WVDP-082, WVNSCO Hoisting and Rigging Manual

WVDP-087, Waste Minimization/Pollution Prevention Awareness Plan

WVDP-098, Environmental Monitoring Program Plan

WVDP-111, WVNSCO Quality Assurance Program |

WVDP-112, Transportation Compliance Manual

WVDP-139, Volume I, Emergency Management Implementing Procedures

WVDP-162, WVDP Nuclear Criticality Safety Program Manual

WVDP-177, Fire Protection Program

WVDP-204, WVDP Quality List "Q-List"

WVNS-EMP-300, Routine WVDP Stack Air Effluent, Monitoring and Sampling

WVNS-EMP-301, Calibrating, Monitoring, and Operating WVDP Stack Air Effluent Monitoring and Sampling Systems

WVNS-FHA-014, RHWF Fire Hazard Analysis

WVNS-TPL-313-001, RHWF Startup Test Program Plan

11.0 REFERENCES

THE FOLLOWING DOCUMENTS ARE REFERENCED HERE FOR INFORMATION ONLY:

West Valley Demonstration Project Fact Book.

EPA/DOE Memorandum of Understanding, dated April 12, 1984.

RC-ALARA-06, Radiological and ALARA Reviews

EP-3-002, Design Basis Documentation

WV-986, Environmental Review Program

WVDP-SAR-023, Preliminary Safety Analysis Report for the RHWF

U. S. District Court, Western District of New York, 1987. "Stipulation of Compromise Settlement: Coalition on West Valley Nuclear Wastes and Radioactive Waste Campaign; v. Department of Energy, United States of America". No. 86-1052-C. May 27, 1987.

11.1 Applicable Congressional Acts

Atomic Energy Act
Clean Air Act
Clean Water Act
Executive Order #11990 - Protection of Wetlands
Federal Facilities Compliance Act
Federal Water Pollution Control Act
LLW Policy Act and Amendments
National Environmental Policy Act
Occupational Health and Safety Act
Pollution Prevention Act of 1990
Resource Conservation and Recovery Act of 1976
Safe Drinking Water Act
Superfund Amendments and Reauthorization Act of 1986, Title III
Toxic Substances Control Act
Water Quality Act
WVDP Act

TABLE I **Attachment A**

Waste Streams to be Processed in the Remote Handled Waste Facility

WS ID #	Description	Anticipated Waste Category	# of Containers	Max. Length (ft)	Max. Width (ft)	Max. Height (ft)	Max. Weight (lb)	Total WS Weight
12	CPC Jumper Boxes	TRU	4	12.96	6.92	6.96	11,697	43,325
13	CPC Jumper Boxes	LLW	8	12.96	6.92	6.96	12,193	85,638
14	CPC Dissolver Vessels includes boxes 3C-1 & 3C-2	TRU	2	19.88	11.79	11.22	35,854	71,708
15	CPC Vessel Boxes	TRU	2	13.72	8.42	8.96	9,942	15,842
16	CPC Vessel Boxes	LLW	6	16.58	11.44	11.02	21,119	65,035
17	Vent Filter Boxes	TRU	76	6.33	7.50	6.0	13,274	304,000
18	Vent Filters in Cement	TRU	4	11.42	7.42	6.42	53,800	191,300
19	Shield Boxes in CPC-WSA	TRU	13	12.50	6.50	6.50	9,648	81,883
20	Shielded Boxes with DAW	LLW	13	12.0	6.0	6.0	10,500	65,000
21	Shielded Resin Tanks	LLW	10	6.0	6.0	6.0	25,430	254,300
22	Shielded Drums	LLW	23	2.0 dia.	Cylinder	3.0	1,390	14,950
23	Waste Tank Farm Pumps	LLW	23	50.0	4.0	4.0	10,000	149,000
24	HEC Closure Wastes	TRU	8	12.0	6.0	6.0	11,800	47,280

Notes:
1. If multiple container sizes exist for a given waste stream (WS), the dimensions shown are for the largest container.
2. Containers in WS18 are shielded with concrete.
3. This table has been reformatted and revised from the original contract documents. Changes in numerical values do not effect the maximum container dimensions or weights to which the RHWF is designed.